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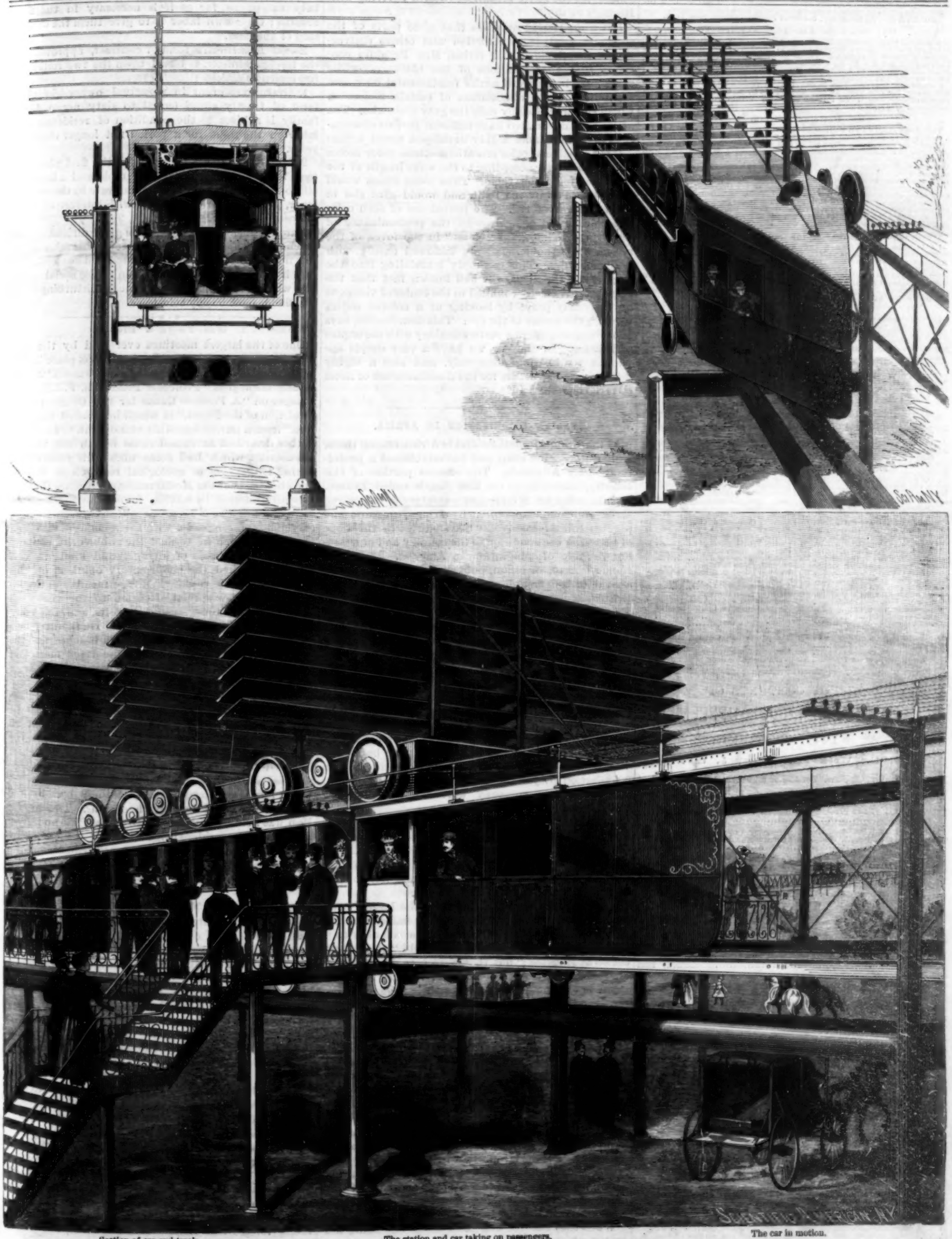

Section of car and track.

The station and car taking on passengers.

The car in motion.

THE CHASE-KIRCHNER AERODROMIC RAILROAD.—[See page 279.]

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A NEW THEORY OF LIGHT SENSATION.

Two recent numbers of *Mind* contain articles upon the new theory of light sensation devised by Mrs. Christine Ladd Franklin, a graduate of Vassar College and the first alumna of that institution to receive the degree of Ph.D. from her alma mater. *Nature* thus compares this theory with those known as the Young-Helmholtz and the Hering theories.

The former of these supposes that the judgment picks out of a mixture of colors all the even red-green-blue sensations, and deceives itself into thinking them to be a new sensation called white. The new theory assumes an independent retinal process as ground for the latter sensation, therein agreeing with Hering's theory.

But while Hering supposes that some parts of the spectrum produce construction and others destruction of the tissue of the retina, Mrs. Franklin considers that the sensations of the black-gray-white series must be regarded as the fundamental ones, and attributed to the dissociation of certain molecules, which she provisionally calls the gray molecules. The atoms thus dissociated have different periods of vibration, and in the more highly developed visual organs—those capable of color sensations—these color atoms differ in behavior according to the wave length of the light beating upon them. Thus some atoms would only be torn off by red light, and would give rise to the sensation of red. The prevalence of such color molecules would coincide with the predominance of the structures known as "cones" in the fovea of the retina, while the "rods" are endowed chiefly with gray molecules. This is simply translating into the language of the theory the well known fact that the color sense is chiefly confined to the center of vision, as anybody may prove by looking at a colored object through the corner of the eye. This distribution, says Mrs. Franklin, offers a perfect analogy with the organs of hearing. In the ear we have a very simple apparatus for hearing noise only, and also a highly differentiated structure for the discrimination of notes of various pitch.

ITALIAN COLONIZATION IN AFRICA.

As the European nations divide Africa among them, Italy is taking her share and has established a protectorate over Abyssinia. The eastern portion of this country, bordering on the Red Sea, is called Eritrea. This is ruled by a civil and a military governor and three councilors appointed by King Humbert, and here an Italian colony has been started in the hope of bettering the condition of the country and of lessening the tide of emigration to America. *L'Illustrazione Italiana*, of Milan, publishes an account of the arrival of the first detachment of peasants taken to Eritrea, at Asmara, a small town near the Red Sea. It is written by some one already resident there and familiar with the country and the colonization scheme. We have taken from the articles some of the most important details respecting the colonists and their future home.

The company consisted of nine families, fifty-seven persons in all, twenty four of them strong laboring men. They are from Lombardy, Milan, and Sicily, and were under the leadership of Baron Franchetti, who was authorized by the Minister of Foreign Affairs to take command of the expedition. The baron has worked with untiring zeal in behalf of this agrarian colonization project, and his face shone with delight when his little company were safely landed last November.

The peasants themselves were pleased with the country from the first. Much had been said to intimidate them before they left their homes. They had been told that "on the Red Sea fire would rain upon them from heaven;" but they saw no fire and felt no more heat than that of an Italian June day.

Their steamer landed at Massaua, the largest town of Eritrea, on an island of the same name near the coast. Those who wished to deter the colonists from starting had told them that they would "die of suffocation at Massaua;" but they were actually very little affected by the tropical temperature. They remained there only long enough to get their luggage transferred to the train at Abd-el-Kader. From there they went up to Asmara on the plateau where their new home was to be. The women and children were greatly interested in the natives, the men felt of the soil, shelled the grain still in the fields, examined the native implements and began to be hopeful of the future. At Asmara, the men grouped themselves around the carts in which their wives and children were to be carried to their final destination, the colonial farm near Circolo, and sang the Italian national hymn. The Asmarians pressed around them and in their way gave the strangers a welcome.

The officials who received them at Circolo were very kind; wine was offered to the adults and cakes to the children. The men were melted to tears, and the women said, "It is too good to be true!"

When they saw the fine grain which was being harvested at the colonial farm and the variety of products raised, their last fears vanished and they agreed that the success of the undertaking was sure.

The fact is that the Eritrean plateau is very similar to Italy in fertility and climate. The various altitudes will admit of their raising tobacco, coffee and cotton, besides grain. The country is so large that there is plenty of room for the emigrants without encroaching upon the rights of the natives. And they have been so much disturbed by the invasion of hostile tribes from the Soudan that they welcome the protection of a civilized government.

The best promise of success for the colony is in the selection of the emigrants. They are honest people, and they understand that they must not expect help except so far as it is necessary in the first months; their own labor is to give them the ownership of the land.

Baron Franchetti's form of contract, approved by the foreign minister, is based upon the two following fundamental articles:

1. Gratuitous grant in perpetual ownership of a farm of twenty *ettari* (equal to sixty acres) for a family is subject to the condition of residence and labor on the same for a period not longer than five years.

2. Money advanced for seed for the first planting, food for the first year, farming tools and a house, is all to be returned at an annual rate in the form of labor, produce, cattle or money, with interest at three per cent.

Baron Franchetti has overcome great difficulties and much opposition in the furtherance of this scheme. If this nucleus of a colony is contented and successful, so that large numbers of families join it, the social problem which is at present so seriously disturbing Italy will find a most happy solution.

Was There a Flood?

One of the largest meetings ever held by the Victoria Institute, of London, England, took place in the third week of March, to hear that well-known "Nestor among Geologists," Professor Prestwich, F.R.S., read a paper on "A Possible Cause for the Origin of the Tradition of the Flood," in which he treated the subject "from a purely scientific standpoint." In it the author described at considerable length the various phenomena which had come under his observation during long years of geological research in Europe and the coasts of the Mediterranean. Among these he specially referred to having found the flints of the drift to be of two classes, one with bones of animals, carved, and interspersed with the remains of man, and the other, which he termed the rubbledrift, containing bones of animals of all ages and kinds in vast heaps. He cited the confirmatory opinions on this point of Professor Geikie, F.R.S., a member of the Institute, and drew special attention to the geological surroundings of these strange deposits, and the manner in which the bones were found. He then referred to phenomena in regard to raised sea beaches, and the constant occurrence of "head," the large masses of transported rock, loam and loess, covering the high plains in Hungary and Southern Russia, and the ossiferous breccias in various localities. From the circumstances attending these and their surroundings he said he had been forced to the conclusion that all their phenomena were "only explicable upon the hypothesis of a widespread and short submergence, followed by early re-elevation, and this hypothesis satisfied all the important conditions of the problem," which forced one to recognize that there had been a submergence of continental dimensions. The Age of Man was held to be divided into Palæolithic and Neolithic, and he considered rightly so. He concluded by suggesting that thus there seemed cause for the origin of a tradition of a flood.—*Bulletin of the Victoria Institute.*

The Yellow Calla Lily.

The white calla lily of our gardens is well known, it still retaining the original name of *Calla*, although botanists have in modern times removed it to another genus, which is called *Richardia*. Calla will, however, long be its common name. It has been frequently hinted that there are species with other colors, which would soon come into cultivation; but, so far, these have been mere rumors. It is now definitely known, says *Meehan's Monthly*, which is good authority, that there is a bright yellow species, which has been named by botanists *Calla Elliottiana*. The one in cultivation, known as *Richardia maculata*, has a slightly yellowish tint sometimes. The new one is said to be a clear yellow, and has leaves spotted with white, similar to our common *maculata*. Only one original plant was introduced, and it is said there are only a few propagated from it in cultivation. Ten plants were recently sold at auction in London, and bought by enterprising florists for $2,000, which is considered the largest figures ever obtained for auction plants. Another yellow one has been introduced under the name of *Calla Pentlandi*, which is said to differ in having larger foliage and richer colored spathes, but which has not yet been offered to the trade.

Cost of an Electric Light Plant.

An article by Mr. J. H. Talbot, in the *Engineering Magazine*, condensed in the *Street Railway and Electrical News*, contains valuable information for city taxpayers or investors interested in the establishment of small electric light stations. If the facts in this article had been given to the public several years ago, without doubt a large waste of capital would have been prevented, and a great many enterprises of this kind now struggling under financial burdens might be in a prosperous and flourishing condition. Mr. Talbot points out how very difficult it has been for persons desiring to establish an electric light station to obtain in advance accurate and definite information regarding its cost of construction and expense of operation, and it is his purpose in the present article to furnish such information.

Mr. Talbot estimates as follows the cost of construction of a plant suitable for a town of from 5,000 to 10,000 inhabitants—one requiring from fifty to sixty arc lights for public use, and about 1,200 incandescent lamps for commercial purposes:

Steam plant of 150 horse power, including foundations, stack, piping, belting, etc.	$5,000
Electrical apparatus in station, including arc lamps, instruments, switchboards, etc.	7,000
Arc circuit, complete, to include poles, wire, hanging of lamps, etc., on the basis of say 8 miles of wire and 5 miles of pole line	2,000
Incandescent circuit, primary, utilizing arc light poles	1,000
Converters for 500-light capacity, leaving balance to be purchased as needed	625
Wiring up, with plain wiring—500 lights—to include lamps and sockets	1,250
Total, excluding real estate and buildings	$16,875

It is thus found that for a plant of the size suggested, the promoters would have to reckon on an expenditure of capital, paid in cash payments, amounting to about $17,000, excluding real estate and buildings.

Mr. Talbot next considers the cost of operating such a plant as compared with total earnings. He believes that the following figures may be taken as approximately correct: $4,250 may be reasonably counted upon as revenue from fifty arc lamps lighted each night from dark until midnight, under contract with the city at $85 per lamp per year, and $7,300 as revenue from incandescent lighting; or a total revenue of $11,550. The expense of operating the plant would be, for labor, engineers, firemen and lamp trimmers, $2,160; fuel, estimated at 750 tons of coal at $2.75 a ton, $2,062; for arc lamps and carbons, incandescent lamp renewals, $1,100; tax and insurance, $600; collections, bookkeeping and stationery, $500; repairs, contingencies and sundries, $500; allowance for depreciation, 7½ per cent on $12,000, $900; or a total cost of operating plant of $7,882. Deducting the operating expense from the revenue, it is found that there is an apparent profit of $3,668. The cost of real estate, of building and of steam power plant depend largely upon local conditions, and no estimates of the items are given by Mr. Talbot.

Natural History Notes.

The Flight of Bees.—According to Prof. Marey's graphic method, bees make 190 wing-beats per second. His method consists in fastening a bee in such a way that its wings are free to move, one of them lightly touching a rotating cylinder covered with a smooth and lightly blackened paper. Prof. Landois, who has studied the sound apparatus of many animals, thinks, from the pitch of the sounds made by the vibrating wings, that they move to and fro at the rate of 400 vibrations per second—more than double those claimed by Marey.

According to Prof. Marey's figures, 190 wing-beats per second would carry the bee over a distance of one mile per minute. If Prof. Landois is right, the distance would be two miles. According to these estimates, it will not be far from the truth to say that bees fly about thirty miles an hour, and that, during an absence of twenty minutes from the hive, they fly about ten to twelve miles. Most observers, however, are inclined to think that bees do not fly more than from eighteen to twenty miles an hour, because the wing-beats of a bee in freedom and under the observer's instrument are not the same.

Every one has observed the comparatively slow flight of the bee when returning home loaded with honey and pollen. Practical examination shows that experiments of this kind are not entirely reliable. Better results are obtained by observing bees in districts where bees were never before found, or by introducing yellow bees were only gray or brown ones are known, or *vice versa*. In such cases it has been seen that the bee never went more than from four to five miles away at the most. The usual distance was two miles. One instance is known in which a beekeeper, on an island seven miles from the coast of Texas, found that his bees went to the mainland for honey and pollen. A practical beekeeper does not expect any great results from flower fields three miles away. They should be no more than two miles distant in a straight line.

The Production of Sound among the Ants.—That ants have some means of communicating with each other is well established. The experiments of Landois and those of Lubbock suggest that this communication is carried on by means of sounds produced and heard by these small creatures, but which the human ear is incapable of appreciating. The observations of Mr. C. Janet, published in *Ann. Entomol. de France* (vol. lxii., p. 159), show that certain species of the Formicidæ, notably *Myrmica rubra*, L., and *Tetramorium cæspitum*, L., are in the habit of making a stridulating noise, probably by reciprocally rubbing superficial parts of the body. A demonstration of this fact is very simple. On a small pane of glass put a ring of soft putty, and after carefully dropping in the middle of the ring, by means of a funnel, a mass of ants freed from bits of earth or vegetable matter, quickly cover them with a second pane of glass and press it down until there is just barely room between the two pieces of glass for the ants to move. If provision has been made for renewal of air, the imprisoned ants will live for several days. On holding this little box of ants to the ear and listening attentively, a murmur is heard very similar to that made by a liquid boiling gently in a closed vessel, and before long distinct stridulations can be heard in the midst of the murmuring. These sounds are heard only when the ants are disturbed.

Mr. Janet concludes that the numerous rugose surfaces which are found on the body of ants in such places that two of them can be rubbed together are probably the organs which produce the stridulating sounds of the Formicidæ. These rugosities have other uses. For instance, those about the articulations serve to hold the body stiff at will at that particular point—an advantage to the animal in pushing or carrying heavy weights up steep slopes.—*Revue Scientifique.*

Courtship among the Flies.—Mr. J. M. Aldrich has made some observations upon this subject, which he records in the January number of the *American Naturalist.* The dipterous family, Dolichopodidæ, perhaps surpasses all other families of animals in the variety and complexity of the sexual adornments of the males. Probably three-fourths of the species offer well marked peculiarities which distinguish the male at a glance. A new species found at Moscow, Idaho, has the fore tarsi in the male exceedingly elongated and slender, with the last joint in the shape of a comparatively large, oval, black disk. The tarsi of the female are of the ordinary simple structure. The maneuvers of the male in courting the female were observed by the author. The fly places himself in front of the female within half an inch, rapidly vibrates his wings, gives his forefeet an up and down motion, raising them simultaneously above his head, and brings them down with a slight force, this movement recurring in about half a second, during some ten seconds. The female hastily moves away a few inches, when the male has to repeat the movements described. The author was much impressed by the perfect coincidence of these observations with Darwin's theory of sexual selection. The reluctance of the females and the corresponding ardor and persistence of the males being carried to an almost incredible limit.

The Number of Plants of the World.—In a paper by Prof. P. A. Saccardo (in *Atti Cong. Bot. Internaz.*), translated by Mr. R. Pound for the *American Naturalist*, the author estimates the true number of species of plants known up to the present time as 173,706; that is, 105,231 phanerogams and 68,475 cryptogams, thus distributed:

Phanerogams	105,231
Ferns	2,819
Equis., Marsil., Lycopod.	505
Mosses	4,609
Liverworts	3,041
Lichens	5,600
Fungi	39,606
Algæ	12,178
Total	173,706

As regards the entire number of species that inhabit the globe, "I think," says the author, "we shall not go far astray in estimating that the flora of the world, when it is completely enough known, will consist of at least 385,000 species of plants (that is 250,000 fungi and 135,000 species of other plants). If one wish only to reduce to 15,000 the species that will appear in these other groups (not fungi), the sum total of plants would ascend to 400,000 species at least." In conclusion, Prof. Saccardo, judging from the rate of progress made up to the present time, thinks 150 more years of research ought to run before we reach a problematical number of 400,000.

The Thorns and Prickles of Plants.—We distinguish in plants two kinds of prickles, those provided with conducting bundles and those that have none. The first have a central cylinder which connects them with the organ that carries them. They are transformed branches or folier organs, and are commonly designated as thorns and spines. The second are of purely cortical, or even epidermic, origin, and are called prickles. Mr. A. Lothelier has undertaken an anatomical study of these two kinds of very distinct organs in considering successively, among thorns or spines, those that possess the morphological signification of branches and those which, being of folier origin, represent leaves, or merely the teeth of leaves, or stipules.

Mr. Lothelier has thus not only ascertained the exact structure of organs as yet incompletely examined in their entirety, but has established the exact origin of a certain number whose true morphological nature was unknown or doubtful.

For example, it is now established that the prickles of *Xanthoxylum planispinum* and *fraxineum*, as well as those of *Capparis spinosa*, are prickles, properly so called; that the spines of the stalk of *Xanthium spinosum* have the value of floral peduncles concrescent with stipules; and that the prickles of the burs of *Castanea vulgaris*, like those with which a large number of fruits are provided (*Datura stramonium*, *Æsculus hippocastanum*, *Ricinus communis*, etc.) represent the teeth of leaves.

In all these, and in many other cases, the anatomy alone permitted of drawing precise conclusions. It was impossible, through external characters, to legitimately prejudge the value of the organ simply from its position upon the plant.

In a general way, the results of Mr. Lothelier's work may be stated as follows:

The spine, when it is due to the transformation of a branch, owes its power of resistance and its hardness especially to the great development of the central cylinder and to the energetic sclerification of the pith, which increases more and more from the apex. It is only quite rarely that the pericycle presents a marked sclerosis at the same time. On the contrary, in the spine that is derived from the leaf, the supporting tissue is in most cases principally formed of the sclerous sheath of the pericycle. The central parenchyma undergoes but a relatively slight sclerification. The stereoma is here found in a zone intermediate between the center and the epidermis.

In prickles, which exhibit a great uniformity of structure, the stereoma is, with rare exceptions, completely relegated to the exterior. As for the origin of these prickles upon the bark, it is, according to the species, of greater or less depth. While superficial in the roses, the mother cells may, in the *Rubi*, for example, be contiguous to the endodermis. In this latter case, we may, if we desire, see a transition between prickles and spines.

Oil from Leather Waste.

A French contemporary of *Industries* contains a paper on the oily matter extractable from leather. The composition of such leather is given as follows:

	I.	II.
	Parts per 100.	Parts per 100.
Water	12	12
Hide	37	36
Tannin	29	28
Fat	18	18
Soluble in water	3·17	5·09
	0·22	0·23
Ash	0·61	0·68

The crude leather is boiled with water, and squeezed until dry under hydraulic presses. The greasy liquor is then treated with sulphuric acid and the purified grease floats on the surface, whence it is decanted off hot and run into barrels to cool. The yield in practice is about 12 per cent. It can, if necessary, be still further purified by washing with dilute sodium carbonate solution. Thus obtained the fat is yellow, melts at 27° C., and has a powerful odor of hide. It has a strong tendency to granulate and separate itself from a reddish brown liquid, similar to goose fat oil. Its odor prevents its being used in soap making, unless it be very thoroughly saponified. Its composition is as follows:

Olein	38	Resinous matter	8
Margarine	18	Water and impurities	2
Stearine	19		—
Fatty acids	15		100

When distilled it is converted into almost colorless fatty acids.

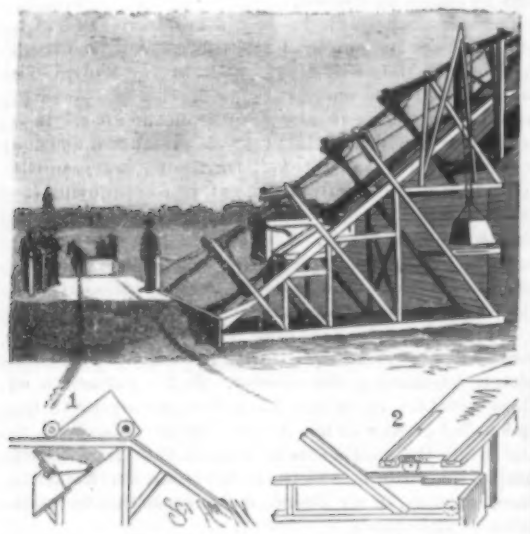
The Corinth Ship Canal.

According to a recent report of the British acting-consul at Patras, the Corinth ship canal is up to the present but little used. Between the opening of the canal in November and the end of February, the only vessels passing through have been a few ships of war, some yachts, and about 200 small Greek sailing craft, although the canal is open to vessels of all nationalities not over 65 feet 7½ inches wide and drawing not more than 23 feet 8¾ inches of water. The tolls charged are as follows: Mail and passenger steamers, either going to or coming from the Adriatic Sea, pay 15 cents per register ton and 20 cents for each passenger carried, both in gold.

The dimensions of the canal are: Length, 3 miles 7½ furlongs; breadth at surface, 80 feet 8½ inches; breadth at bottom, 68 feet 11 inches; depth, 24 feet 3 inches. The usual strength of the current in the canal is about one knot, occasionally rising to from two to three knots an hour, when great care in the navigation is required to prevent vessels from bumping against the steep sides of the canal. Although some additional lights have been placed in the Gulf of Corinth, steamship companies require still better lighting before deciding finally to adopt the canal route.

AN INCLINE ELEVATOR AND DUMP.

This improvement comprises a derrick of simple but strong construction, forming inclined tracks, on which travels a car having wheels in different planes, there being at one end a low down dump where the car receives its load, and the contents of the car being automatically discharged into a chute at the upper end of the incline. The invention has been patented by Mr. Samuel E. Kurtz, of Greenfield, Iowa. The large view shows the application of the improvement, Fig. 1 representing the car dumping its load, and Fig. 2 the bottom of the incline, where the load is received, below the level of a dumping platform, upon which a loaded wagon may be readily driven. At the bottom of the inclined tracks are upper and lower parallel tracks, the upper tracks being narrower than the lower ones, and the car comes to a level at the point where it receives its load, as the rear wheels run down to the lower



KURTZ'S ELEVATOR AND DUMP.

tracks without striking the upper tracks. The car is drawn up by a cable passing around a pulley on a cross bar at the upper end of the tracks, thence back and around a pulley on the car, and again around a pulley on the cross bar, from which the cable leads over guide pulleys to a point convenient for attachment to a whiffletree or the axle of a wagon, so that the team bringing the load may furnish the power by which it is elevated and dumped. At the front lower corner of the car is a downwardly swinging door with end flanges overlapping the sides of the car, and adapted to drop into connection with a chute delivering to the desired receptacle in the usual way. The door is held normally closed by gravity catches, which are automatically released when the car is pulled up to its limit, the door being automatically closed again as the car rolls backward. A counterweight is arranged to prevent the too rapid descent of the car, and a rack is also arranged in the framework and a pawl and ratchet on the car. This elevator is very inexpensive to build, costs nothing for power, and is designed to be especially useful to farmers and others for elevating materials into storage bins and for similar purposes.

POLISHING AND BUFFING LATHE.

The lathe shown in the illustration is designed for heavy work. It has extra long babbited boxes, giving the spindle sufficient bearing to insure stiffness. The width of head is reduced to facilitate work upon large irregular pieces, and it is especially adapted for bicycle, stove, chandelier or car trimmings work, permitting the use of a large wheel without jar or spring. The lathe is made in several sizes, with detachable steel taper ends in the next lower size to take the smallest brush or buff. They are designed to be run at a higher speed than any in the market. They are made by the Hanson & Van Winkle Company, of Newark, N. J.

Money Value of Hands and Fingers.

The following estimate of the relative value of the hands and of the several fingers is taken from the *British Medical Journal:* According to a scale drawn up for the Miners' Union and Miners' Accident Insurance Companies, of Germany, the loss of both hands is valued at 100 per cent, or the whole ability to earn a living. Losing the right hand depreciates the value of an individual as a worker 70 to 80 per cent, while the loss of the left hand represents from 60 to 70 per cent of the earnings of both hands. The thumb is reckoned to be worth from 20 to 30 per cent of the earnings. The first finger of the right hand is valued at from 14 to 18 per cent, that of the left hand at from 8 to 13·5 per cent. The middle finger is worth from 10 to 16 per cent. The third finger is valued at no more than 7 to 9 per cent. The little finger is worth 9 to 12 per cent. The difference in the percentages is occasioned by the difference in the trade, the first finger being, for instance, more valuable to a writer than to a digger.—*Food.*

Railway Rates in India.

In the United States we are apt to consider our railroad rates as lower than those of other countries, and this is probably true of freight, but in passenger rates the Indian railroads go far below ours. The government report on Indian railroads for the year ending March 31, 1893, which has lately been issued, gives the average rate on all freight at 1·023 cent per ton mile; our rate for 1892-93, according to the Interstate Commerce Commission reports, was 0·898 cent. Our average on passenger business, however, was 2·126 cents per passenger mile, while the Indian railroads charged only 0·645 cent. This rate was in silver, but it must be remembered that wages and other charges are paid in silver also, though imported machinery must be paid for in gold at a premium. The lowest average rate was found on the Madras Railway; it was 0·414 cent per passenger mile. This rate would give fares in this country of about 37 cents from New York to Philadelphia, 99 cents from New York to Boston, about $3.75 from New York to Chicago, and about $14 from New York to San Francisco.

These low rates are made both possible and profitable by the dense native population which furnishes the railroads with an enormous number of passengers who are satisfied with the cheapest kind of accommodations, provided the charge is low. Over 95 per cent of the passengers are carried in the fourth-class cars, which are used only by the natives, and hardly 1 per cent use the first-class. While in this country the average passenger train load is 42 persons, on all the Indian roads it was last year 231, or over five times as large, while in one case—the East Indian Railway—the average was 247 persons.—*Eng. and Min. Jour.*

Smoke Prevention.

In a recent experiment at Glasgow, Scotland, *Engineering Mechanics* says the coal used showed 31·40 per cent gas, tar, etc., 48·70 per cent fixed carbon, 0·84 per cent sulphur, 6·56 per cent ash, and 12·50 per cent water. Before treatment analysis showed that the products of combustion contained 5·8 grains of sulphuric acid per 100 cubic feet, and after treatment 2·8, while in another case the reduction was from 9·5 to 4·2. As to soot, the first test showed a decrease from 73·5 grains to 2, and the other test from 23·3 to 1·5 grains. In other words, from 94 to 97 per cent of the soot was removed and fully a half of the sulphuric acid. Tests showed that the draught was not affected, being 5 inches in the flue and 4 inches in the chimney.

A Babcock & Wilcox boiler was used, driving a 220 horse power engine, and consuming 3 tons of coal and a ½ ton of scraps and chips. Before entering the usual chimney the gases ascend a short brick flue, and then descend a flue of steel plates dipped at a high temperature in a tar composition, entering the ordinary stack at the bottom. At the bottom of the ascending flue is a jet of steam at boiler temperature, while at the top of the descending flue is a fine spray of water. The carbon is thus separated, and, with the water, drops into a sump at the foot of the descending flue, being thence carried off in pipes.

POLISHING AND BUFFING LATHE.

AN EXTENSION LADDER FOR SLEEPING CARS.

How inconvenient it sometimes is, especially for the aged and the feeble, to reach the upper berth in a sleeping car, has often been noticed by travelers on our railways. To obviate such inconvenience, and enable the traveler to readily get into the upper berth and descend therefrom, is the object of the improvement shown in the illustration, which consists of an extension ladder adapted to be folded and swung out of the way when not in use. It has been patented by Mr. John B. Holbrook, D. K. E. House, Ithaca, N. Y. Upon the usual removable transverse partition separating the upper berths from each other is a hinge connected with an arm or bar forming the upper end of the ladder, which is made in sections adapted

HOLBROOK'S EXTENSION LADDER FOR SLEEPING CARS.

to slide upon each other. When swung outward the ladder drops down nearly to the car floor, just outside the lower berth. To facilitate folding the ladder, a tape extends from the lower rung of the bottom section up through the several sections, passing through an eye to a spring-pressed drum fixed within convenient reach. By pulling on this tape the occupant of the upper berth can readily fold the ladder, which is then swung inward against the side of the partition. When the car is made up in the morning, the partition board is stored with the ladder attached.

High Railway Speeds.

High speeds on railways formed the subject of the inaugural address of M. Du Bosquet, president of the French Society of Civil Engineers. He states that the reason speeds are not maintained on the level is because the engines are not sufficiently powerful for this. Some experiences with the dynamometer made with speeds from 37 to 75 miles, and of which the results have been extended to greater speeds, show that for the same motive force of 17·2 lb. per ton, a train reaches a speed of 75 miles on a decline of one-half of one per cent, 57 miles on the level and 31 miles on an incline of one-half of 1 per cent. To increase the average speed by a small amount, the power of the engines must be much greater. If 800 horse power is sufficient to draw a train at 75 miles an hour up an incline of one-half of 1 per cent, 2,900 horse power will be required to draw the same train up the grade at a speed of 125 miles per hour. In high speeds the weight of the engine per horse power generated is important, as there is always a limiting speed beyond which the engine cannot draw itself, let alone a train. Really high speeds, the speaker stated, will be obtained only by diminishing the weight, per horse power, of the locomotive, and by limiting the load to be hauled to a minimum.—*Railway Engineering and Mechanics.*

Protection against Serpent Bites.

Dr. Calmette is continuing, at the Pasteur Institute, a series of interesting experiments on the poison of serpents commenced by him while residing in Cochin China. He has obtained excellent preservative effects by inoculating or injecting viper's blood in various animals. He treats it first by heat or by chemical agents, such as hyposulphite of soda. His theory is that venomous animals are unaffected by their own poison. His results confirm those recently obtained by MM. Phisalix and Bertrand at the laboratories of physiology and chemistry at the Paris Museum.

Egypt in the Time of Moses.

We are only beginning to understand the height of civilization to which Egypt and other ancient countries around the Mediterranean had attained even before the time of Moses, says Sir John William Dawson, in the *Expositor*. Maspero and Tomkins have illustrated the extent and accuracy of the geographical knowledge of the Egyptians of this period. The latter closes a paper on this subject with the following words:

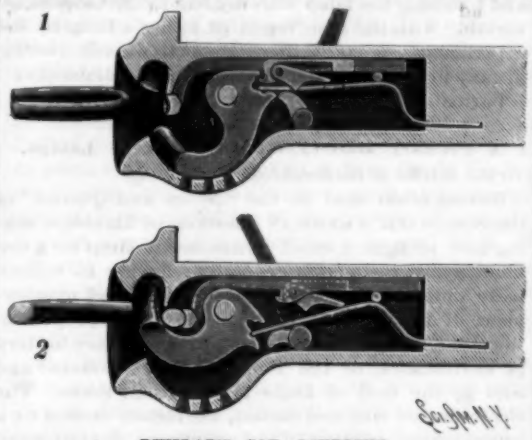
"The Egyptians, dwelling in their green, warm river-course, and on the watered levels of their Fayoum and Delta, were yet a very enterprising people, full of curiosity, literary, scientific in method, admirable delineators of nature, skilled surveyors, makers of maps, trained and methodical administrators of domestic and foreign affairs, kept alert by the movements of their great river, and by the necessities of commerce, which forced them to the Syrian forests for their building timber, and to Kush and Pun for their precious furniture woods and ivory, to say nothing of incense, aromatics, cosmetics, asphalt, exotic plants, and pet and strange animals, with a hundred other needful things."

The heads copied by Petrie, from Egyptian tombs, show that the physical features of all the people inhabiting the surrounding countries, as well as their manners, industries, and arts, were well known to the Egyptians. The papers of Lockyer have shown that long before the Mosaic age the dwellers by the Euphrates and the Nile had mapped out the heavens, ascertained the movements of the moon and planets, established the zodiacal signs, discriminated the poles of the ecliptic and the equator, ascertained the law of eclipses and the precession of the equinoxes, and, in fact, had worked out all the astronomical data which can be learned by observation, and had applied them to practical uses. Lockyer would even ask us to trace this knowledge as far back as 6,000 years B. C., or into the post-glacial or antediluvian period; but, however this may be, astronomy was a very old science in the time of Moses, and it is quite unnecessary to postulate a late date for the references to the heavens in Genesis or Job. In geodesy and allied arts, also, the Egyptians had long before this time attained to a perfection never since excelled, so that our best instruments can detect no errors in very old measurements and levelings. The arts of architecture, metallurgy, and weaving had attained to the highest development; civilization and irrigation, with their consequent agriculture and cattle breeding, were old and well understood arts; and how much of science and practical sagacity is needed for regulating the distribution of Nile water, any one may learn who will refer to the reports of Sir Colin Scott Moncrieff and his assistants. Sculpture and painting in the age of Moses had attained their acme, and were falling into conventional styles. Law and the acts of government had become fixed and settled. Theology and morals, and the doctrine of rewards and punishments had been elaborated into complex systems. Ample material existed for history, not only in monuments and temple inscriptions, but in detailed writings on papyrus. Egypt has left a wealth of records of this kind, unsurpassed by any nation, and very much of these belongs to the time before Moses; while, as Birch has truly said, the Egyptian historical texts are, "in most instances, contemporaneous with the events they record, and written and executed under public control."

There was also abundance of poetical and imaginative literature, and treatises on medicine and other useful arts. At the court of Pharaoh, correspondence was carried on with all parts of the civilized world, in many languages, and in various forms of writing, including that of Egypt itself, that of Chaldea, and probably also the alphabetical writing afterward used by the Hebrews, Phenicians, and Greeks, but which seems to have originated at a very early period among the Mineans, or Punites, of South Arabia. Educations were carried on in institutions of various grades, from ordinary schools to universities. In the latter, we are told, were professors or "mystery teachers" of astronomy, geography, mining, theology, history, and languages, as well as many of the higher technical arts.

AN IMPROVED CAR COUPLING.

This coupling has a spring-pressed hook to engage the link, and a slide for locking the hook in open position, the slide being adapted to be engaged by the entering link. The construction is very simple, the cars fitted with this improvement being automatically coupled as they come together, while the uncoupling



DUNLAP'S CAR COUPLING.

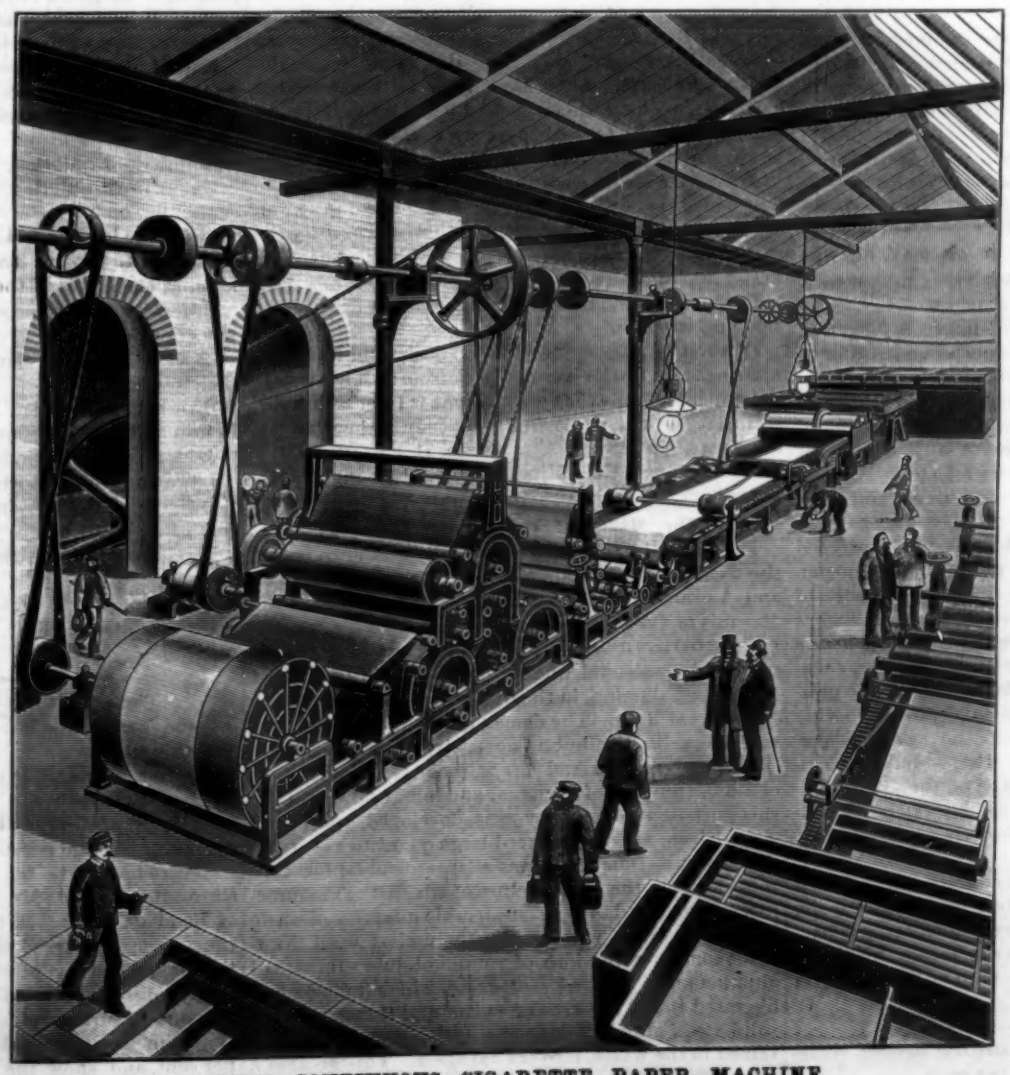
may be conveniently effected without the need of trainmen going between the cars. The invention has been patented by Mr. William Dunlap, of San Diego, Cal. Fig. 1 is a sectional view showing the hook in open position, and in Fig. 2 the link is engaged by the closed hook. The hook has trunnions journaled in the sides of the drawhead, and its rear end has a lip pressed on by the end of a spring, which may be lifted by a cam on a transverse shaft connected with a rod, at whose outer end is a handle at the side of the car. On the same end of the hook is also a second lip, above the first one, adapted to be engaged by a hook on the under side of a slide, whereby the coupling hook may be locked in open position. The forward end of the slide is bent down, and has a head or cross-piece extending into the mouth of the drawhead, above the free end of the coupling hook, so that an entering link will strike the head of the slide and move it rearward, disengaging the coupling hook, and permitting the spring to swing the hook upward to engage the link. On the slide is pivoted a dog whose free end rests on top of the spring, and on the under side of the dog is a lug passing through a slot in the spring, the lug being adapted to be engaged by the cam actuated by the handle lever, whereby the slide may be moved forward to lock the coupling hook in open position. A notch in the rear end of the hook is also adapted to be engaged by the end of the spring to lock the hook in closed position, the spring being disengaged from this notch by swinging the cam upward by means of the handle lever. Further particulars of this improvement may be obtained of Mr. E. M. Reinhardt, C Street, between 26th and 27th Streets, San Diego, Cal.

Prizes for Hay and Clover Making Machines.

In connection with the Darlington meeting of the Royal Agricultural Society of England for 1895 the following prizes are offered by the Royal Agricultural Society of England for: Class I.—For the best hay making machines, first prize, $100; second prize, $50. Class II.—For the best clover making machines, first prize, $100; second prize, $50. All prizes are open to general competition. The trials will take place during the hay harvest of 1895, on land selected by the society in the neighborhood of Darlington. The necessary arrangement for the grass and clover crops required for the trials will be made by the society. Notice of the place and date of the trials will be posted to every competitor as soon as they are fixed. Every competitor must himself provide for the delivery of his machines on the trial ground, and for the removal of the same after the trials. Horses will be provided by the society to work the machines during the trials, but competitors who desire it may provide their own horses. Every machine must be delivered at the depot on the trial fields in proper working order not less than two days previous to the commencement of the trials. The competitor will find one attendant to drive and work each machine. Any assistance given by the competitor himself or other workman will be noted by the judges. The order in which the several machines will be tested will be determined by the stewards, who will decide by lot. Machines are not to be worked under conditions as to weather and crop when such machines would not be used in the actual work of a farm. The attention of the judges and engineer will be particularly directed to the following matters: Price; weight; simplicity, strength, and construction; efficient protection of the gearing, and freedom of the machine from choking; excellence of work in turning and lightening up of the crop without damaging it; draught in work. Should the judges find any of the machines to be of practically equal merit, they are empowered to bracket them as equal, and so divide the prize money. Entries for the prizes in any of these classes must be made on or before Monday, April 1, 1895, and must be accompanied by a deposit of $5 for each entry.

CIGARETTE PAPER.

Cigarette paper is a superior article, presenting numerous qualities. Good cigarette paper should be very thin, very uniform as to pulp, and very strong and resistant. It ought not to become disintegrated when it is slightly wet; in burning it should leave but a small quantity of ashes, and not give out a disagreeable odor; and, finally, in burning, it should not disengage substances injurious to the health.



BUROT'S CONTINUOUS CIGARETTE PAPER MACHINE.

Superior cigarette paper is manufactured exclusively from linen rags. It weighs 9½, 10 and 15 grammes per square meter. In burning it emits no odor.

Ordinary cigarette paper is manufactured from substitutes. Its pulp often contains a certain amount of wood pulp, especially the paper designed for export. Such paper is heavier and weighs from 12 to 20 grammes to the square meter. In burning, it may emit a slight odor, because the wood pulp contains resin, the combustion of which disengages gases offensive to the smell. In reality, the odor is perceptible only in paper containing large proportions of wood pulp. Apart from that, the quantity of resin contained in the paper is so small that the combustion always proceeds nearly without odor.

In its broad lines, the manufacture of cigarette paper does not differ from that of ordinary fine paper. A single point is special, and that is the finishing, which has to take a long time and be well done. The pulp must be finished slowly, progressively, and with as short fibers as

possible. The duration of the process, which is executed in improved vats, varies between 15 and 30 hours, and it is upon it that depends the weight to the square meter.

It requires a special manipulation and perfect machines to obtain a sheet of paper presenting great strength with a pulp composed of so short and so divided fibers.

By way of example, we give a figure of a continuous machine for cigarette paper constructed by Mr. Burot, of Angouleme.

This machine comprises the following apparatus: 1. Three mixing machines, with scoop wheels, in which the discharge is regulated by a gate. The two wheels are provided with copper scoops and serve, one of them for the pulp and the other for the water. 2. A distributing chest, with an agitator serving to mix the water and pulp well before passing to the sand collector. 3. A revolving and rocking sand collector, easy to clean. 4. Two pulp strainers whose shake-motion is noiseless. 5. A table with a cloth 11 meters in length, and with a carriage combined with the apron, so that the size can be changed during the travel of the paper, thus permitting of reducing cuttings. 6. Two suction apparatus, operating through atmospheric pressure, for extracting water from the sheet of paper. 7. A pulp roller, or "dandy," for pressing out the water from the paper. 8. A wet or couching press, whose rollers are of cast iron, and whose adjusting screws are provided with rubber cushions, so as to render the pressure elastic. 9. A suction apparatus for the felts of the couching rollers, and designed to remove the air from between the paper and the felts, in order to prevent blisters. 10. A squeeze roll. 11. A battery of five 1·2 meter driers. 12. A second battery. 13. Two superposed reels permitting of winding two sizes of paper at once.

The operation of this machine is very simple to any one who has visited a paper mill or who saw the paper machines of the Exposition of 1889.

We shall now give some practical information as to the various qualities of cigarette paper that will prove of a certain utility to consumers.

The shade of the paper is not of much importance. Ordinarily, cigarette paper possesses the natural color of the pulp of carefully bleached rags, blued or not with ultramarine. Some manufacturers, however, give it a chamois color. This color is in very much demand in Russia.

The thickness is of some importance. We have already said that good paper weighs 10 grammes to the square meter. The pulp should be fine and regular, and the thickness should be very uniform throughout the entire surface. The consumer greatly appreciates such qualities.

The strength is of still more importance. It is upon this that often depends the commercial value of a paper. For use, resistance in a transverse direction is required.

The tenacity of cigarette paper diminishes, as a general thing, when its weight increases. This is easily explained, because only rags are employed in the fine papers, while into thick papers a certain proportion of wood pulp enters.

The ashes left by the combustion of cigarette paper merit attention. The less ashes a paper leaves, the easier its combustion; but the differences are slight. Cigarette paper leaves from 0·5 to 1 per cent of ashes. It is, therefore, formed of pure fibers, since filtering paper, prepared chemically, and with the greatest care, leaves from 0·10 to 0·22 per cent of ashes.

The ease of combustion of the paper is judged of from the ashes that it leaves after burning. In order to increase such combustion, certain manufacturers impregnate their paper with a very small quantity of saltpeter or chlorate of potash. In no case should cigarette paper after burning leave any residua of carbon. Such a paper ought to be rejected.

Finally, let us be permitted to put an end to a legend: The injurious effect of the paper upon the health. Were there any danger, it might proceed from two causes: (1) From the products of the combustion of the paper itself; (2) from the presence of poisonous materials in the paper. Of the products of combustion, there could be no question, since, in the conditions in which the combustion takes place, there is produced only water or carbonic acid. The presence of poisonous substances is a myth, for supposing that traces of them are found in the ashes, as certain analysts have advanced, that would constitute but an infinitesimal proportion of the same material in the paper; so smokers can be assured in advance that cigarette paper is absolutely innocuous to the health.

We shall not speak of special cigarette papers, such as those prepared with tar, amber, essential oils, etc. These are prepared like ordinary paper, but are covered, nearly at the end of the manufacture, with such substances, either by a special bath or by means of rollers.—*La Nature.*

THE loss of champagne, by bursting bottles, sometimes amounts to as much as 25 per cent.

Correspondence.

The Static Effect in Incandescent Lamps.

To the Editor of the Scientific American:

In No. 5937, A. E. S. refers to "northern lights in miniature," produced by holding an incandescent lamp over a belt in motion, and states that after replacing the lamp in its socket it immediately burned out. I have repeatedly produced the same effect by developing static electricity by walking over a carpeted floor and touching the lamp with my hand. Met almost invariably with the same result of losing a lamp by the experiment. What is there about this static electric display in a vacuum that destroys carbon filaments?

Faribault, Minn. A. C. R.

A Primary Battery for Incandescent Lamps.

To the Editor of the Scientific American:

Having often read in the "Notes and Queries" of the SCIENTIFIC AMERICAN questions of amateurs asking how to light a small incandescent lamp for a few hours a day, the answer generally referring to bichromate and storage cells, the construction and management of the latter requiring some skill, I propose to the amateur electrician the following primary battery (a modification of the Fuller battery), mounted and sold by the firm of Dalle Molle & Co., Rome. The electrodes are zinc and carbon, the former excited by a concentrated solution of sal ammoniac, the latter (inclosed in a porous cell) depolarized by the following simple solution: 100 grammes of sulphuric acid are poured into the porous cell, which is then filled with a solution of bichromate of potash, 80 grammes to the liter. To restore the action of the battery, sulphuric acid and bichromate of potash may be added. The zincs must be amalgamated. It is also advisable to paraffine the upper part of the porous cell. I tried several batteries, but this is certainly the best for small lamps.

Propaganda, Rome, Italy. F. HAUSHAHN.

A Cure of Snake Bite.

To the Editor of the Scientific American:

Last fall, in company with Mr. H. Carlos, of Cape Gracias, Nicaragua, I was coming down the River Pis-pis in the Sumo country, from the Constancia gold mine. Stopping one evening at a Sumo Indian village, we found that the chief had been bitten on the foot by a *tomagas*, the most venomous snake in this country. The man was in the most pitiable condition. Thin, watery blood was issuing from his mouth, nose, ears, and even from the tattoo marks on his arms and breast. His urine was also discolored by blood.

The people were all clamorous for us to give him some *Merican seekia* (American medicine), knowing that we always carried a medicine chest with us. It happened that we had been discussing that same day the various remedies for snake bites, and Mr. Carlos had said that he heard that to cauterize the wound with carbolic acid and give the same internally was a sure cure. After explaining to them that it had been so long since he had been bitten it might not be possible to cure him, we decided to try the above cure. The question was how much to give him. We decided upon three drops dissolved in glycerine, in half wineglass of water. We gave him two doses at an interval of half hour that evening. Two hours after the second dose we gave him an emetic that greatly relieved him and he soon went to sleep.

The next morning we gave him another dose of the acid and left him.

I was on my way to the World's Fair and have just returned. Mr. Carlos has got back from another trip to the mine, and tells that our patient is fully recovered, and that he had successfully treated another one the same way.

La Constancia Gold Mine, Pis-pis, Nicaragua, C. A. GEO. B. PENSE, Supt.

The Mines of Bauxite in Ireland.

The mineral bauxite was practically unknown before the year 1870. In 1872 Messrs. George G. Blackwell and Alexander Sutherland arranged a lease with the Marquis of Downshire for a very large royalty, consisting of 2,000 to 3,000 acres, and in a year or two afterward produced a splendid quality of bauxite, testing about 54 per cent alumina in the dry state and from 1½ to 1¾ per cent iron. The demand for this mineral was then very limited, but as chemistry progressed there came numerous demands for its use in the manufacture of alum, sulphate of alumina, and alum cake, and for this purpose the property was developed and levels were driven, which produced large quantities of bauxite. At this time there was a large demand for beet root sugar, in the manufacture of which the manufacturers discovered that a considerable quantity of waste remained, which was practically useless until Newlands conceived the idea of running liquid sulphate of alumina on to the beet root waste, which immediately liberated the 20 per cent of sugar and transposed the sulphate of alumina, consequent upon the potash contained in the waste, into crystal alum. This became a very profitable operation, as it produced from the practically waste substance a large quantity of sugar, and converted the sulphate of alumina into crystal alum, which was resalable at considerably higher figures than had been paid for it as sulphate of alumina, while the sugar was produced practically free of cost. Subsequently the Bauxite Company, limited, was formed. This company have, in consequence of the increased demand for the ore, put down a new shaft at considerable expense, and enlarged the tramway and depot to such an extent that they are prepared to deliver 2,000 tons of bauxite per week. The shaft is now completed, entirely new machinery has been erected, and improved and increased tram lines have been laid down. The ore, of the usual finest quality, has been struck at a depth of 146 feet, and the company is now prepared to supply this mineral, testing about 54 to 57 per cent alumina in the dry state and from 1·5 to 2 per cent iron oxide. This new find of bauxite has increased the value of the property to an extent that cannot at present be estimated, inasmuch as there is an enormous demand for the ore for the purposes before stated, and particularly for the purpose of producing aluminum metal, which can be done at a very low cost from this mineral, as well as the manufacture of a firebrick of a very refractory nature. The mines are situated at Strain, near Ballyclare, County Antrim, in the north of Ireland. The celebrated Giant's Causeway is in this county. The principal shipping port is Larne. Some of the White Star liners have called there and been supplied with tonnage for their trial trips, and on one occasion some 900 tons were loaded in the small space of nine hours. Thus the Bauxite Company, limited, are able to supply this mineral of unequaled quality, and in quantities that cannot be produced anywhere else.

What Buildings Cost per Cubic Foot.

The *American Architect* of February 17 contains an article which will interest fire underwriters and adjusters. The writer says:

"With materials and labor at the same price, two buildings of the same character, although of different sizes, will be found to cost approximately the same per cubic foot; hence the cost of a proposed building may be closely estimated by multiplying its cubic contents by the known cost per cubic foot of a similar structure built in the same locality." The cost of similar buildings in other localities can be estimated according to the difference in cost of labor and material.

The cost per cubic foot of well known buildings in various cities was as follows:

Rookery building, Chicago, eleven stories, iron and steel interior, ten passenger elevators, 32 cents per cubic foot.

Monadnock building, Chicago, sixteen stories, rich marble work, 42½ cents.

Masonic Temple, Chicago, twenty stories, fourteen passenger elevators, rich marble work, 58 cents.

New England Mutual Life Insurance Company's building, Boston, granite, fireproof, 60 cents.

Herald building, New York, 200×140, two stories and attic and damp proof basement, 46 cents.

Six to ten story office buildings in New York, 30 to 60 cents.

Wainwright building, St. Louis, ten stories, 25 cents.

Union Trust building, St. Louis, fourteen stories, 28 cents.

Equitable Life Insurance Company's building, Denver, nine stories, first story marble wainscoted nine feet high, 42 cents.

Ernest & Cranmer building, Denver, eight stories, pressed brick fronts, 17 cents.

Crocker building, San Francisco, ten stories, steel skeletoned, 63 cents.

Brown-Palace Hotel, Denver, nine stories, finished in iron and onyx, 30 cents.

Athletic club buildings, about 24 cents.

Libraries, from 36 to 44 cents.

Dwellings, Boston, frame, eight to ten rooms, 11 cents.

Dwellings, Denver, first class, stone, steam heat, 27 cents.

Brick cottages, East, ten rooms, about 15 cents.

Brick cottages, East, one and one-half story, 10 cents.

The Worthington Pump in India.

Some recent tests have been made of the new large Worthington pumping engines supplied to the Love Grove sewage pumping station at Bombay to the order of the municipality. The engines and pumps are capable of dealing with from 60,000,000 to 78,000,000 gallons of sewage per day, and for the purpose of the trial care had to be taken to ascertain accurately the slip on the pumps. Mr. James, the drainage engineer at Bombay, says: "In the trials that have been taken the sewage discharged has been measured not only by the pumps, but by observation in the outfall sewers, and the discharges as taken by floats and by inclination due to surface of sewage come out rather more than the discharge taken from the pumps, less five per cent, and show the slip of the pumps with good valves to about three per cent.

THE CHASE-KIRCHNER AERODROMIC RAILROAD.

We have given considerable space in our columns to the experiments with aeroplanes, as executed by Prof. S. P. Langley, Hiram Maxim and others. These experiments have led to the determination of certain facts. A flat plate or surface maintained in a horizontal position and moved horizontally through the air experiences a greater resistance to its descent than it would if it descended vertically. If the surface is inclined so that its advancing edge is higher than the rear edge, it will experience a lifting effect, and under proper conditions will rise upward. Such a contrivance is termed an aeroplane. An aeroplane short in the direction of its motion receives a relatively greater sustaining effect per unit of its area than does a large one. A set of Venetian window blinds gives the idea of a good arrangement of aeroplanes.

In the present issue we illustrate a proposed high speed railroad, in whose operation aeroplanes take a part. By this system the attainment of a speed of 150 miles an hour is claimed to be possible, while for long distances a rate of 125 miles an hour is hoped for. The projectors hold that the railroad of the present time must be supplemented by some system admitting of higher speed.

To reach this speed, curves must be abolished, as the centrifugal force will be too great to be withstood. Accordingly, as far as possible, the line will go right across country from point to point, without regard to grade. Next, the road must be free from interruption; there must be no possibility of any obstacle getting on the track. This makes an elevated structure the proper one, and the one shown in the cut has been designed to secure the essential features of strength and safety. It includes an upper and a lower pair of rails, and a pair of trolley wires or leads.

The cars are of special design, with sharp ends, so as to encounter the minimum of air resistance. In cross section they are of sufficient dimensions to present the comforts of a Pullman car. They will have a trussed steel frame and metal sides, tops and floors. They are carried by wheels four to six feet in diameter, which wheels are to be placed near their tops, so that the cars will be virtually suspended from the upper rails. The axles of these wheels pass through journals near the car roof. One or more pairs of these wheels are to have two electric motors connected to their axles, so as to serve as driving wheels. The speed being so high, there will be no trouble in using direct connected motors without gearing.

The current is taken from each trolley wire by its trolley wheel, which works on an axle at about the level of the axle of the driving wheels. On the trolley wheel axle, which will be insulated, are secured collecting rings, against which brushes bear. A closed metallic circuit is to be used, two trolley wires and a pair of trolley wheels being used on each car.

So far all is simple enough, the peculiarities of the system centering on the points of straightness of line, lowering of center of gravity of car below the rails, and high speed. It is essential that there should be no curves, and any grade met is to be climbed; no deviation of route to secure an easy grade is to be allowed.

This will give many severe ascents to be overcome, and it is here that the distinguishing peculiarity of the system comes in. The car carries a series of aeroplanes, each one twenty to thirty feet long and four to five feet wide. They are mounted so as to be capable of setting at any desired angle. At a speed of 150 miles an hour, a slight inclination would give them a very powerful lifting effect. On the level they will be kept practically straight. When a grade is reached they will be set at an angle, so as to have a lifting effect. This will be graduated, so as to leave just enough traction in the driving wheels to propel the cars. It is obvious that the limit might be passed, and the wheels might turn without getting grip enough to drive the train. Here a self-regulating feature is apparent. If the wheels slipped, the car would move with reduced velocity and the aeroplanes would lift less weight. At once the traction would increase and the car would move forward, so that eventually an equilibrium would be established. It is claimed that the amount of work necessary to drive a car at high speed up a grade would be greatly diminished by the use of aeroplanes.

Underneath the car is a second set of wheels, ordinarily inactive. Above them is a line of rails inverted. By a system of levers and an air pump the engineer can throw these wheels upward at will, so that they will press against the lines of rails above them. This affords a means of increasing the traction to any desired extent, as the upper and lower wheels are thus made to act as the jaws of a clutch. The increased rolling friction thus produced may be applied for direct traction or for braking. These wheels also provide a safeguard against all swaying, or lifting of the car from the track by the aeroplanes.

In the running operation the engineer will be guided by the nature of the ground. On the level he would probably hold the aeroplanes flat and inactive. When a grade is reached, he will incline them enough to partially lift the car. The car then begins to move up in part at least upon an inclined plane of air. Its acquired velocity as well as direct traction assist this operation. It reaches the top of the grade with slightly reduced velocity, but very quickly recovers its loss. On a down grade the aeroplane may be inactive or may be turned so as to provide an enormously powerful aeroplane brake.

It is proposed to use alternating current motors, which on present lines would admit of a distance between power stations of some 200 miles. It is claimed for the system that it is as safe as the present one, has greater speed and equal comfort and luxury, is adapted to all kinds of traffic, and will be profitable. It is calculated that a straight line from New York to San Francisco would be 500 miles shorter than the present one. The construction of an elevated road across the continent seems an appallingly great piece of work, but in the United States to-day there are railroad bridges enough to give a continuous line of track from Sandy Hook to the Golden Gate. The absence of snow blockades and washouts, the abolishing of the expense of replacing railroad ties and of maintaining a ground track, the economy of the trolley system, the power to utilize water wherever met with near the line, are cited as advantages. New York and San Francisco would be brought within twenty-four hours of each other, and a route crossing Bering's Strait would bring Paris nearer in point of time than it now is by the ocean route. The use of the structure for pneumatic tubes, telephone and telegraphic wires, is obvious and is suggested by the projectors.

Electric Signaling Balloon.

The electrically signaling balloon which Mr. E. S. Bruce exhibited some two years ago, and which has since been approved by the British and Belgian governments, has now found favor with the Italian war department. The principle of the balloon is exceedingly simple. Inside a balloon with a translucent envelope a little ladder headed with six incandescent lamps is fixed, and the lamps are connected with a battery on the ground by a wire which runs side by side with the cable tethering the balloon. By means of a Morse system of long and short flashes, which illumine the balloon, messages can be telegraphed to distant points, the only requisite conditions being that the night shall be dark and clear enough. The simplicity of the invention is the most striking thing about it, and leaves one wondering that it was discovered only two years ago. The balloon which is being sent out to Italy, and which was on view recently at the Kensington town hall, is made of cambric and its envelope is perfectly translucent. It has a diameter of 18 ft. and a gas capacity of about 3,200 cubic feet. The lamp-holder for containing the six incandescent lamps, which are suspended inside the balloon, is in shape of a ladder, to admit of easy introduction into the narrow mouth of the balloon. The balloon equipment includes net, valve top, hose for filling, sand bags, and a special ventilated case for sea transport. The signaling lamps are sixteen candle power, fifty-five volts, and are specially constructed for the purpose. The signaling key-board contains the Bruce signaling key, with removable carbon contacts, an ammeter, a switch to turn on the current to the lamps, either through the key for flashing signals or directly for continuous illumination, a switch to throw the ammeter into the circuit, and a safety cut-out. The weight of the whole thing amounts to less than 150 lb., and it can be packed into a receptacle the size of a lady's traveling basket.

Train Ferries.

"The people of this country," says the New York *Mail and Express*, "have for some time been familiar with car ferries which transport whole trains across rivers or estuaries so broad and deep that the traffic does not justify the expense necessary for bridging them. In New York Harbor this service has been extended, and both passenger and freight trains are regularly transported by boat the length of the East River and across the Hudson, making a railroad connection between New England and the Atlantic coast to the south of us without change of cars or break of bulk.

"The same service was inaugurated by the Central Pacific at the Straits of Carquinez, where the ferry steamer Solano carries twenty-four passenger cars or forty-eight freight cars, with the locomotive, across a strait in which the current attains a velocity of eight miles per hour, embarking and landing its train in about fifteen minutes. The New York, Philadelphia & Norfolk Railroad has for about ten years maintained a car ferry between Cape Charles and Norfolk, Va., a distance of thirty-six miles. There is also a car ferry at the Straits of Mackinac, which, by the aid of screws in the bow and stern, maintains regular trips through the heavy ice at the foot of Lake Michigan. All of the above mentioned ferries, except that between Cape Charles and Norfolk, are on sheltered routes, and are not exposed to rough weather.

"The Toledo, Ann Arbor & Northern Michigan Railroad Company, however, has inaugurated a line of ice-breaking car ferryboats to run sixty-five miles between Kewaunee, Wis., and Frankfort, Mich. These boats have been run through two winters and the intervening summer with entire success. The ice, unless over twenty inches thick, does not interfere with their movements, and the cars are so fastened that they do not roll on their trucks in the fiercest gales. This trip of sixty-five miles is made in five hours when there is no ice.

"It seems as if the experience we have gained in this country ought to be made available for our comfort when passing between London and Paris. The distance is less than one-third of the Lake Michigan trip, and although the rise and fall of the tides is greater than is the case with any American car ferry, the arrangement of the necessary docks and hinged bridges would require nothing more than an extension of principles and practices that are well understood in this country.

"There seems to be nothing in the way of running unbroken trains between London and Paris, except the necessary capital and the employment of sufficient technical skill. If the London, Chatham, and Dover would combine with the Northern of France and employ an experienced American engineer to plan and construct the docks and appliances for embarking and landing the trains, and at the same time send to any of the shipbuilding establishments on our great lakes for a man to construct the ferry boats, the arrangement could be perfected in a year and a half or two years, when freight and passengers could be transported from any part of Great Britain to the Continent, and eventually to all of Asia and Africa, without change of cars or break of bulk."

The Tannin of Tea.

A. Hilger and Fr. Tretzel have studied the chemical characters of this constituent of tea, in regard to which very discordant accounts have been given by various authorities. In order to obtain a pure product, green tea was operated upon by first extracting with boiling water, evaporating the clear liquor to the consistence of a thin sirup, and then shaking with acetic ether which had been digested with magnesia. The ethereal solution containing tannin, together with chlorophyl and products of its alteration, was then distilled, the residue treated with water, and on evaporating the clear water solution the tannin was obtained perfectly free from ash. It presented the appearance of a chocolate brown powder, readily soluble in water, alcohol, acetone, or acetic ether, sparingly soluble in ether, and insoluble in chloroform. The water solution gives with ferric chloride a deep blue coloration, with gelatin solution a precipitate. Elementary analysis and the behavior of the acetyl compound of this tannin show that it has the composition and general characters of an anhydride of digallic acid, and not those of a glucoside. By long continued action of dilute sulphuric acid, the tannin of tea is converted into gallic acid and a phlobaphen.—*Forsch. Ber. u. Lebensmittel*, 1893, p. 40.

Water Drinking in Typhoid Fever.

In the March number of the *Revue de Médecine* Dr. Hector Maillart, of Geneva, concludes an article on this subject. As a result of his study of it, he feels convinced that the treatment of typhoid fever by copious drinks may be recognized as a definite method. In order that the treatment may be efficacious, the patient should drink at least from five to six quarts of water daily during the whole febrile period. There is no contraindication to this treatment; feebleness of the heart, far from contraindicating the drinks, may become a special indication for them. The results are a progressive lowering of the fever, disappearance of the dryness of the tongue and mouth and pronounced sedation of all the alarming nervous, circulatory, and renal phenomena.

These results are due to the oxidation of toxines and refuse material, which are rendered soluble and eliminated. The oxidation is shown by the formation of great quantities of urea, and the elimination takes place by the skin and kidneys in the form of profuse sweating and abundant diuresis. This diuresis reestablishes the integrity of the renal filter, and that results in the rapid disappearance of albuminuria. This method of treatment has no notable influence on the course or the duration of the disease. No unpleasant consequences have been observed to result from the treatment, either during the fever, during convalescence, or after recovery. The treatment, which is very acceptable to the patient, is easily carried out, even in cases in which the nervous disturbances are very decided.—*New York Medical Journal.*

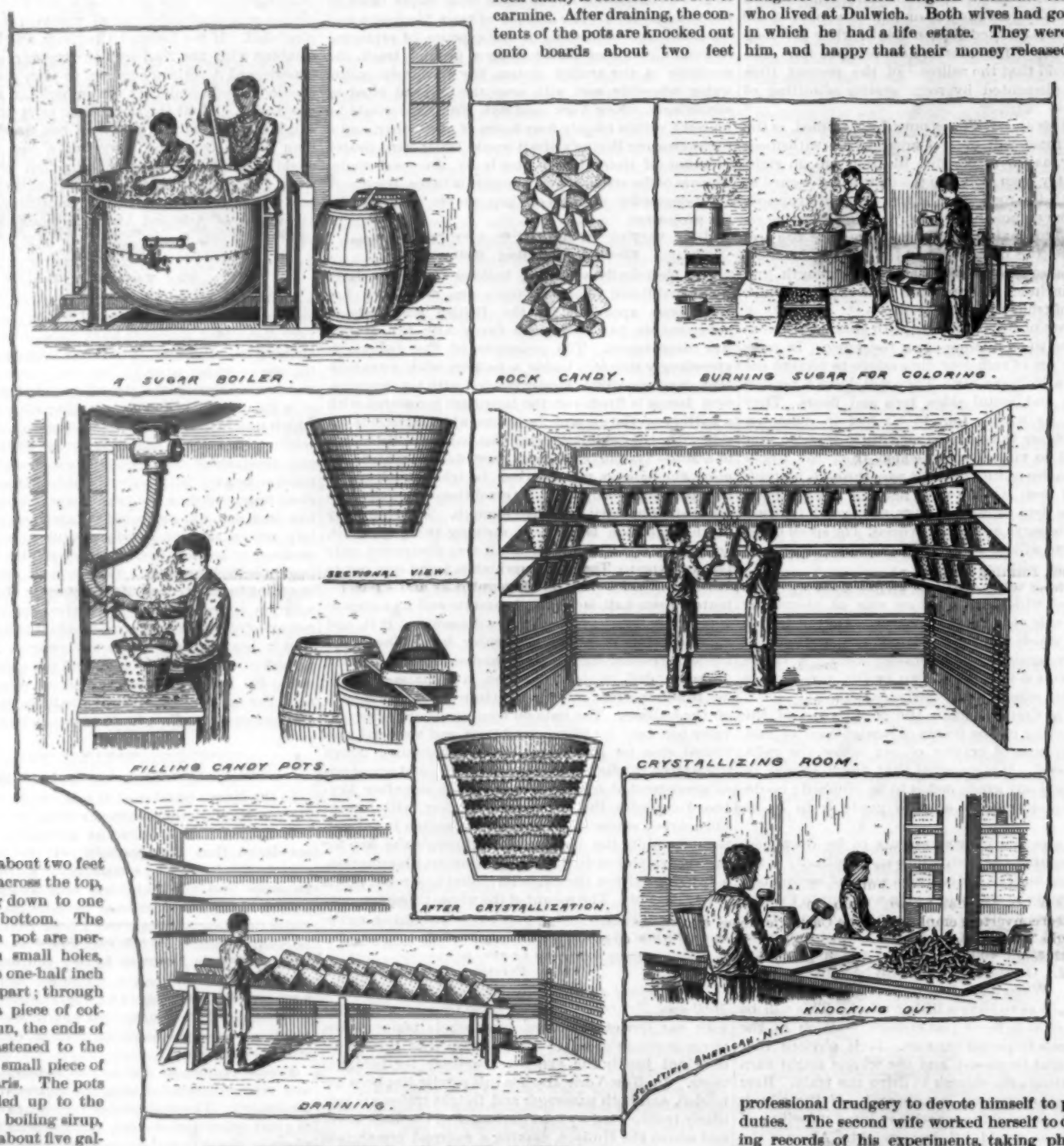
Dangers of Celluloid.

A clergyman writing to the London *Standard* comments upon the dangers of the highly glazed washable celluloid collars which have come into such general use of late. In the particular case mentiond by the clergyman, a boy's collar became ignited by a spark, and burning with the almost explosive violence characteristic of di-nitro-cellulose in the open air, so injured the lad that he soon died.

MANUFACTURE OF ROCK CANDY.

Rock candy is a crystallized sugar sirup, which, after boiling and being kept at a certain temperature, forms itself on to strings suspended across the interior of circular copper pots. The first process in its manufacture is the boiling of the sirup. About four barrels of the finest grade of sugar, with about sixteen gallons of water, is first put into a circular copper boiler, about five feet in diameter and about three and one-half feet in height. Inclosed around the sides and bottom of the boiler are a number of coils of steam pipe, which, when turned on, causes the material to boil and form itself into a sirup. Water is also applied to the sides of the boiler to prevent the sirup from sticking. After the material has boiled for about one-half hour, it is run off through a number of fine sieves at the bottom, and passes down through a four-inch hose to the copper candy pots below. These pots are circular in form, being about two feet in diameter across the top, and tapering down to one foot at the bottom. The sides of each pot are perforated with small holes, ranging from one-half inch to one inch apart; through these holes a piece of cotton cord is run, the ends of which are fastened to the outside by a small piece of plaster of Paris. The pots are then filled up to the top with the boiling sirup, which holds about five gallons and of forty pounds weight, and carried away by two attendants to what is called the hot house. This hot house is made entirely of brick, and is about fourteen feet square and about one foot in thickness, each side being fitted up with shelves made of heavy planking. Underneath these shelves, attached to the side walls, are a number of two-inch steam pipes, which, when turned on, furnish the required heat. The attendants place the heated pots side by side on these shelves, where they are left for two or three days in a temperature of about 100 degrees, the heat of which causes the best part of the sugar to crystallize onto the strings. After the expiration of three days, a crust of crystallized sugar is formed on the top of each pot of about one-eighth inch in thickness. The interior sides and bottom also have a crystallized coating of about one inch, while the inferior part remains in a liquid form. The pots are then taken out of the hot house, the plaster scraped off, and the uncrystallized liquid poured off into a tub, where it is remelted and filtered and run into barrels, to be sold to liquor and soda water dealers. The pots are then taken and rinsed out with water to take the sirup off the candy, and then taken to the draining room, where they are placed bottom up in an inclined position, one against another, in a trough, and left to drain about one day in a temperature of about 70 degrees, which dries and also gives the candy a glossy appearance.

For yellow rock candy the liquid is colored with burned sugar. About eighty pounds of sugar and three gallons of water is mixed together and placed in a shallow circular copper pan about three feet in diameter and placed over a hot fire, where, by boiling and constant stirring, it is allowed to get thick, black, and burned. When properly burned, it is taken out and placed in a tub and diluted with water. It is then run through fine brass sieves, and is ready for use. An intense smoke issues from the burning sugar, causing the attendants to wear respirators. The red rock candy is colored with No. 40 carmine. After draining, the contents of the pots are knocked out onto boards about two feet square. This is done by an attendant turning the pot upside down and whacking the sides with wooden mallets, causing the candy to fall down into a heap. The strings are then separated from each other and weighed out and packed into from five to forty pound boxes. Twenty-one hands turn out about 182,324 pounds of rock candy and 106,359 gallons of rock candy sirup yearly. The material is sold principally to confectioners, liquor dealers, and grocers. The wholesale price per thousand pounds for rock candy is 7·44 cents per pound. The sketches were taken from the plant of the Tournade Palisade Manufacturing Company, West Hoboken, N. J.



THE MANUFACTURE OF ROCK CANDY.

A New Comet.

A cable message from the European Union of Astronomers announces the discovery of a faint comet, discovered by Mr. W. F. Denning, of Bristol, England, the following being the discovery position: March 26.396 Gr. M.T. R.A. 9h. 55m. Decl. +32° 15'.

The Late Dr. Brown-Séquard.

Mrs. Crawford, the Paris correspondent of the London *Daily News*, gives a very interesting biographical notice of the eminent savant, whom she knew personally, and who told her that his father, one Brown, was a native of Galway, and entered the American naval service in 1812. He was engaged against the English in different actions, and sent to the Mauritius, where he fell in love with a French girl named Séquard, whose father was a planter. A few weeks after Brown's marriage he was directed to return to the United States, but was attacked by pirates within sight of the father-in-law's mountain villa, and his ship captured. He probably walked the plank, as he was never more heard of. Dr. Brown-Séquard was a posthumous child, and was born in 1818. He was brought up in his native isle, and acquired there his Creole gracefulness of manner. Dr. Séquard's second wife was a Mrs. Doherty, the daughter of a rich English wholesale tea merchant, who lived at Dulwich. Both wives had good fortunes, in which he had a life estate. They were devoted to him, and happy that their money released him from professional drudgery to devote himself to professorial duties. The second wife worked herself to death making records of his experiments, taking photographs, and helping in many other ways in his laboratory. He was so absorbed in what he had to do that he did not notice her exhaustion until she broke down utterly. As she was faultlessly exact, her help became indispensable. She had had no kind of training for the tasks she undertook before she married him, and broke herself in by dint of application.

Dr. Brown-Séquard was eloquent and interesting as a professor and in conversation. He carried his hearers on and away, and though his memory was stored with technical terms, used them as little as he could. Almost any ignoramus could understand him. He had most expressive black eyes, and looked rather the seer than the man of science. Within the last ten years the treatment by hypodermic injections that takes his name aroused much controversy in the medical world. Professor Germain Sée was quite against it. Charcot finally came to the conclusion that distilled water would be just as stimulating as "Séquardine." Dr. Brown-Séquard's special practice was in the treatment of nervous diseases, in which he frequently operated cures that seemed marvelous.

A CARPENTER'S MAKESHIFT.

A good mechanic will generally have his tools in good order, but through accident or the meddling of some careless or ignorant individual, even a good mechanic may find tools out of order and requiring attention before they can be used.

Our artist the other day sketched a carpenter who, evidently having become tired of a dull saw, resorted to the expedient illustrated. Not having a suitable vise at hand, he inserted his saw back downward in a

AN EXTEMPORIZED SAW VISE.

kerf in the timber on which he was working, and proceeded to file his saw as though it were held in the most approved manner.

A LARGE PUNCHING MACHINE.

The Cockburn Barrow and Machine Company, of Jersey City, N. J., have recently completed one of the largest punching machines ever built in this country, of which an illustration is herewith presented. The company have heretofore made many powerful, quick-working punches, running without gears, but this is a triple gear machine, with only two shafts, working in the same way as the back gear of a lathe, while it is also adapted to run without gear, for quick punching, without shifting the belt. To run direct from the belt, the gear wheels are moved out of mesh by means of the hand wheel, when the fly wheel and main driving wheel are locked together, a change which can be made in less than two minutes, and the machine will then have a speed of one hundred revolutions a minute, and will punch 3⅛-inch holes through ¾-inch steel plate. When the gears are in mesh, the machine makes ten turns a minute, and will punch holes four inches or more in diameter through 1-inch steel plate. The machine has 50-inch gap, and the lower jaw is made to take a die ten inches in diameter, facilitating the heaviest punching work required by boiler makers and shipbuilders. The machine was built for Messrs. Wm. B. Pollock & Co., of Youngstown, Ohio, makers of the heavy steel converters employed at the Carnegie works. It weighs thirty-five tons, and occupies a floor space of 4 × 12 feet. The pressure obtained in the machine is about 400 tons.

A DISPATCH from Aalesund, Norway, April 24, says the American North Polar expedition under the command of Mr. Walter Wellman sailed to-day for the island of Spitzbergen on the steamer Ragnvold Jarl. The American aluminum boats which the expedition carries were greatly admired here for their beauty, strength and lightness. As the steamer left the quay the stars and stripes were hoisted at the foremast head, and salutes were fired. All the shipping in the harbor was decorated with flags in honor of the Arctic explorers. A large fleet of small boats escorted the Ragnvold Jarl out of the harbor.

French Exploration in South Africa.

The Paris Geographical Society listened, at a recent meeting, to an account of a journey from the Cape of Good Hope to Lake Nyassa, by M. Edouard Foa. His address is given at length in the *Revue Francaise de l'etranger et des Colonies et Exploration Gazette Geographique*, and from this we take some of the most interesting facts presented.

The region north of the Zambesi, and extending from that river to Lake Nyassa, is the field of his exploration hitherto least known. The expedition was organized at Quilimane, situated in Mozambique on a northern mouth of the Zambesi, and from there it started up the river. The party consisted of four Europeans, including M. Foa, and twenty-eight Arabs. Upon their arrival at Nyassa, two of the Europeans and eleven of the Arabs had died from fevers or other diseases; the rest of the company was nearly prostrated from fatigue, privation and disease, but they had penetrated a region never before explored by Europeans.

This country between the Zambesi and Lake Nyassa covers an area of 68,312 square miles. The average altitude of the valley is about 1,100 feet above sea level. The surface is diversified and covered with rough vegetation. Numerous chains of mountains of an altitude varying from 1,800 to 6,000 feet traverse the territory. At their base are a great many streams, many of which are dry a part of the year. The climate is unhealthy along the rivers, but is more agreeable among the mountains. The average temperature is 95° Fah. in the day time and 68° at night. Some parts of the region the population is dense, in others it is very sparse. The natives are clothed with the bark of trees and skins. The Azimbas are a tribe with numerous branches, which are armed with bows and arrows, and their hair is adorned with feathers of many colors.

The natural resources of the country are undoubtedly great. Gold and other precious metals, coal, copper, and especially iron, are abundant. India rubber, gums, dye and cabinet woods, textile plants, skins, indigo and other products will one day swell the volume of commerce along the river.

M. Foa gave thrilling accounts of episodes of the expedition. For two and a half months he and a part of his men were separated from the others and held prisoners in a region devastated by famine and the incursions of a hostile tribe, by the swollen rivers, which from sometime dry fords were changed into impassable torrents.

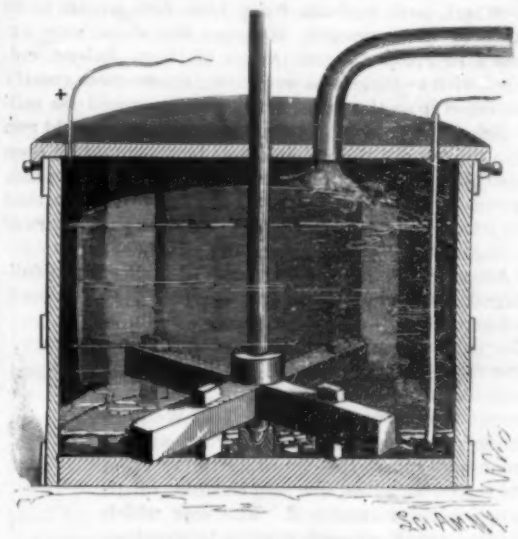
The party lived entirely upon game, but suffered much from want of food, and three died of starvation, during this time. An elephant hunt and a lion chase were among the minor episodes described.

M. Foa dwelt upon the fact that the English are rapidly extending their protectorate in the African lake region.

THE tide tables for the Atlantic coast of the United States, together with 207 stations on the Atlantic coast of British America, for the year 1895, published by the U. S. Coast and Geodetic Survey, are now ready for issue, and copies can be obtained at the agencies of the Survey in this city, or by addressing the office at Washington. Price, 25 cents.

A METHOD OF AND APPARATUS FOR AMALGAMATING ORES.

The freeing and amalgamating of gold or silver, either from free milling or base ores, by this method, is designed to save all the metals capable of being decomposed by an electric current from aqueous solution. The invention has been patented by Mr. Hubert F. Edwards, of Butte, Montana (box 910). The tank employed is preferably of wood, or of any material forming a poor conductor, to prevent the freed gold and silver from being plated on its sides, and in the bottom of the tank is a bath of quicksilver. The crushed ore or pulp with which the tank is charged is kept stirred by an agitator, con-



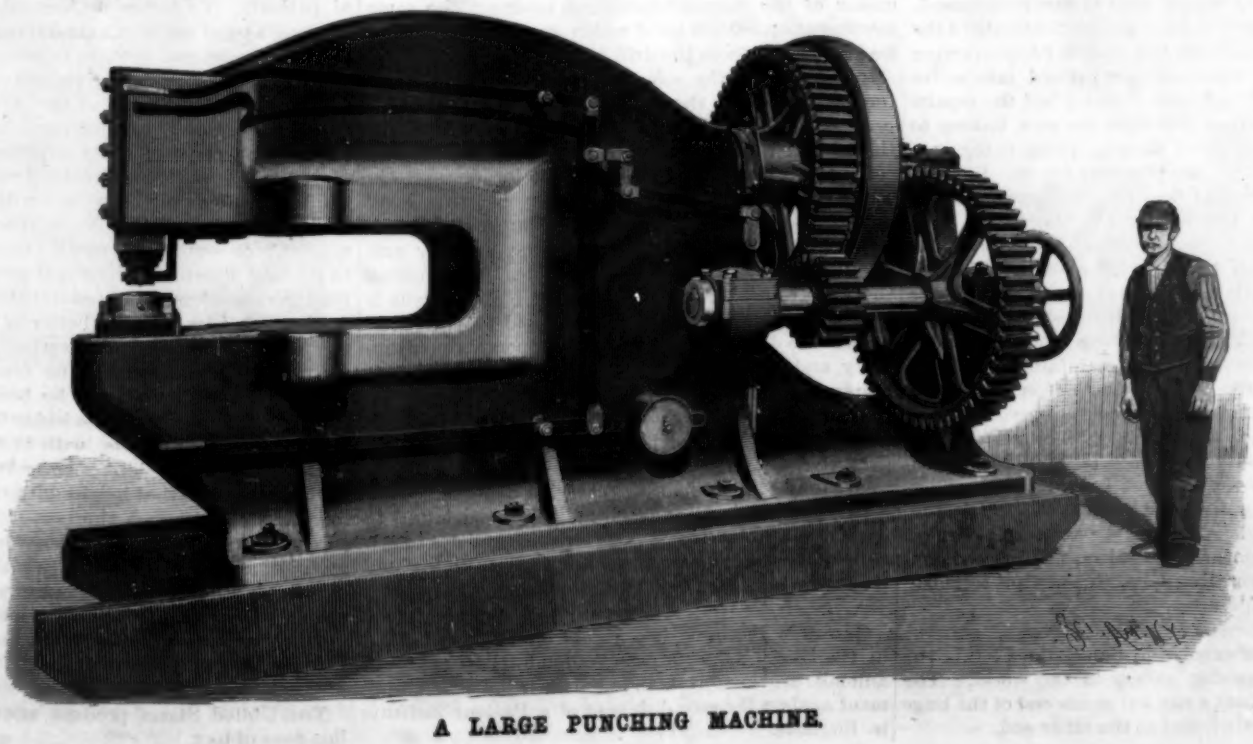
EDWARDS' ORE AMALGAMATING APPARATUS.

sisting of a central vertical shaft with radial blades and paddles, and from the top of the tank leads a pipe connecting with a suitable condenser, so that the vapors and gases generated during decomposition of its contents by the electric current may be condensed and used. The tank is lined with carbon or similar plates, whereby the liquid in the tank is connected with the positive pole of a battery, +, while the negative pole is connected by a wire, —, with the quicksilver in the tank bottom, the wire being led in through a suitable insulator.

According to the method of the inventor, the crushed ore or pulp supplied to the tank is mixed with some decomposing conducting chemical liquid or solution of some salt, as an aqueous solution of cyanide of potassium, which, when decomposed by the electric current, reacts on the metals united with the gold or silver, and is capable of dissolving the precious metals themselves, the solution being decomposed by the electric current to liberate the free gold and silver. The particles of silver and gold are amalgamated with the quicksilver at the bottom of the tank, and are thus charged negatively, the potassium also collecting at the negative pole, while the cyanogen separated combines with hydrogen to form prussic acid, the main part of which goes off as gas, hydroxide of iron being held in solution in the water. By this method the loss due to the flowering of the quicksilver is avoided, and the formation of calomel or other quicksilver salt is prevented.

Another Mississippi Bridge.

Mr. Huntington, president of the Southern Pacific Railroad, has signed a contract with the Phœnixville Bridge Company for the construction of a bridge for the company's line over the Mississippi near New Orleans. The bridge, which will cost five million dollars, will be ten thousand five hundred feet long, with a double track. It will be built on the cantilever principle. The object of its construction is to give the Southern Pacific an all-rail entrance into New Orleans.



A LARGE PUNCHING MACHINE.

Icebergs in the Southern Ocean.

If we may judge from reports from many vessels plying around Cape Horn, and between Europe and Australia, the Antarctic regions furnish a most extraordinary supply of icebergs.

A recent number of the *Nautical Magazine* gives accounts from the masters of nearly 200 ships sailing during the last year and a half, in which they report having met with ice, ice floes and icebergs extending over an area of apparently several millions of square miles, say from 40° to 60° south latitude and from 158° west longitude to 50° east longitude. The icebergs were of astonishing dimensions, some not higher than the sea level, others rising to a height of 1,500 feet, and in bulk from 1,000 feet square to 25 miles or more square. Many of the ships were exposed to great danger. Some of them, indeed, collided with icebergs and were lost; others were greatly damaged from the same cause. Ships would be sailing along, and being overtaken by a fog, would run into the bergs. Sometimes great bergs would be seen to capsize and the under part then became the top, appearing to be covered with earth and rocks, so that they looked like dry land. We will cite particulars of a single example of many equally narrow escapes:

After a voyage extending over 11 months, the full-rigged ship Wellington, Captain E. B. Broomhead, belonging to the Shaw, Savill & Albion Company, arrived at Plymouth Sound first week in April with 12,000 carcasses of mutton and a quantity of wool and grain from Picton, New Zealand. The Wellington left Picton on May 12, last year, and all went well until she was 1,000 miles from Cape Horn, when several terrible hurricanes were encountered. The seas which washed over the vessel were of tremendous force and caused considerable damage. One of them washed the wheel and the man steering across the deck, the sailor having his arm broken. The same sea dashed Captain Cowan, who was then in charge of the ship, to the deck, and his head was badly cut. The mate was thrown with such force against the side of the vessel that one of his legs was broken; it has since been amputated. Eleven days later, when the Wellington was 250 miles east of Cape Horn, a terrible and fatal accident occurred. At four a. m., in thick and stormy weather, the ship struck with terrific force a huge iceberg. The stem was carried away to within three feet of the water's edge, as well as the whole of the starboard bow and a part of the port bow. The bowsprit, foretopgallant mast, royal yards, freezing and galley funnels, and many other spars were also carried away, leaving the vessel almost a wreck. A good many of the crew were in their bunks, and two seamen, named Flemming and Wilson, were killed. At first it was feared that the ship would sink, and the crew prepared to launch the boats. When they got clear of the iceberg, however, it was found, much to the surprise of all, that the vessel was not leaking to any great extent, and the captain decided to make for Rio de Janeiro in order to effect temporary repairs. On arrival at Rio, 41 days after the accident, Captain Cowan returned to England and Captain Broomhead took charge of the vessel, the repairs to which were at once commenced. This was in the month of July, and on September 5 the revolution broke out. Work was at once stopped, owing to the fact that the workmen were pressed into active service. From that time until January last the repairs could be effected only at intervals, the men having to work in the midst of great danger, owing to the continual fighting between the opposing forces. In order to get out of the line of fire, the Wellington had to shift her berth in the harbor five times, and even then she had several narrow escapes. Three Nordenfelt shots passed through the ventilators of the ship, but fortunately very little damage was done. One of the crew who had deserted was drowned in trying to rejoin his vessel. Two apprentices were invalided home, but otherwise the crew maintained excellent health. On January 24 the Wellington set sail for England. Exceptionally fine weather prevailed until the English Channel was reached, 56 days from Rio, when strong easterly winds set in, and during the night Captain Broomhead put back from the Start for Plymouth to obtain the services of a tug to tow the ship to London. Although the cargo had been on board nearly 12 months, the mutton was in good condition, as the refrigerating apparatus was not seriously damaged.

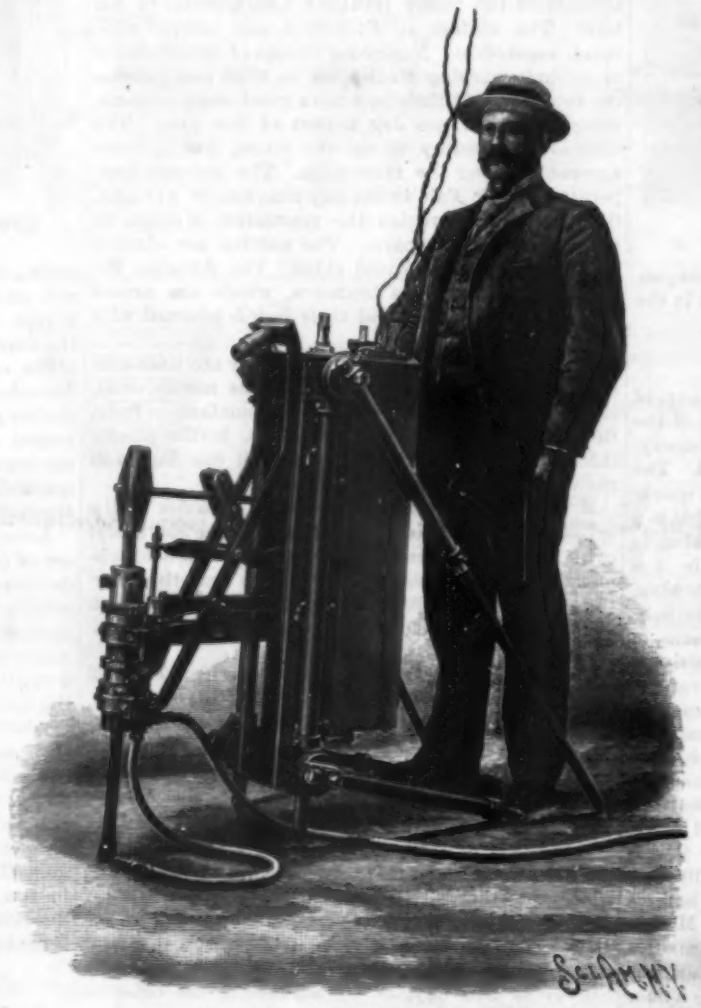
THE Mormon Tabernacle in Salt Lake City is the most perfect whispering gallery in the world. The dropping of a pin into a silk hat at one end of the huge structure is distinctly heard at the other end.

NOVEL ELECTRIC ROCK DRILL.

For conveying power into remote corners no more convenient means can be conceived than is afforded by electricity. As the current may readily be conveyed anywhere through a small and comparatively inexpensive cable, it is especially adapted for operating machinery for mining and quarrying. It is the invention of Mr. G. W. Pickett.

We illustrate a new rock drill operated by electricity, which seems to embody all the desirable points found in other drills, besides possessing the advantage of having greater portability on account of the use of electric cables in lieu of pipe or hose.

This machine, as will be seen by reference to the engraving, is very compact. It is arranged to deliver blows upon the drill rod in much the same manner as hand drills are operated by means of hammer; but in this case the motive power never tires. The hammer is operated by means of armatures or plungers drawn alternately into two oppositely arranged solenoids. The frame which carries the hammer is mounted upon a guide frame attached to the casing of the solenoid. The machine is adjustable, so that the drill can be operated either vertically or horizontally, or at any desired angle. The drill holder, which is carried by the adjustable frame, is arranged to rotate, and is furnished with a ratchet acted on by a pawl reciprocated by means of the hammer-operating lever. The same movement operates a pawl which turns a nut on the feed screw and feeds the drill forward.



NEW ELECTRIC ROCK DRILL.

In the ends of the solenoids are buffers to prevent too great shock to the machine should the resistance prove too light to absorb all the energy developed by the blow of the hammer, or should it be accidentally set in operation when not in position for doing work. The connection between the hammer-operating lever and the hammer arm is not positive, but permits of a certain amount of play between the hammer arm and the lever, and a buffer is provided for arresting the upward motion of the hammer. The current is automatically shifted from one solenoid to the other, so that the drill after being started operates continuously and automatically until a new adjustment is required. In this drill there are no small, easily disarranged, delicate parts. There is no chance for undue wear, and its construction is such that should any part give out, it can be replaced by such mechanics as are found in mining and quarrying districts.

Patents covering this machine have been issued in the United States and various foreign countries to Mr. Samuel Lesem, whose offices are in the Mining and Exchange building, Denver, Colorado.

CANON Wilberforce, in a recent interview published in the *Westminster Gazette*, contends that the lower animals are immortal, and uses his belief as an argument against the establishment of a Pasteur institute in England.

Large Scale Photographic Maps of the Moon.

In 1890 Dr. Langley sent out a circular relative to the making of a photographic map of the moon. Very successful experiments in enlarging the negatives made at the Lick Observatory have shown that it is perfectly practicable to produce such a map on a large scale, by directly enlarging the focal negatives made at Mount Hamilton. Some of the features of the moon, as crater pits, are better seen in enlargements than in any other way. An atlas on the scale of 3 feet to the diameter of the moon would be the best for ordinary use, while one with a diameter of 10 feet would be on the largest scale, which presents a distinct advantage. "It is hoped," says Prof. E. S. Holden, "that the 3 foot and 10 foot atlases will be made in the near future. At any rate, the scientific problem is now solved, and only the financial one remains."

Improved Hospitals.

A lecture was recently given before the Society of Architects in Berlin, by Herr Boettger, on the present state of the science of hospital planning, which has much interest. Says the *The American Architect:*

As nearly every summer sees some important congress of sanitarians or physicians, at which hospital construction is discussed, it is not strange that ideas on the subject are brought forward, tested, and abandoned, or developed further, in rapid succession, and the hospitals of this year differ materially from those of even three or four years ago. According to Herr Boettger, while there is very far from being unanimity among experts on many points of hospital design, it is generally agreed that, for large establishments, with more than one hundred beds, the system of wards connected by corridors is to be condemned, and that isolated pavilions should be exclusively employed. It has usually been considered that, with isolated pavilions, the cost of supervision and service is much greater than where the wards are connected by corridors, but Herr Boettger says that, if the buildings are carefully grouped around the administration offices, this is not the case. The theory once prevalent, that hospitals for cities must be at or near the center of population, is also becoming obsolete. Great improvements have been made in the rapidity and comfort of ambulance service, and the most recent hospitals are built far enough outside the cities to secure fresh air. The immense new establishment at Hamburg, which comprises eighty-one separate buildings, is about five miles from the city, and so careful are hospital directors to avoid what Herr Boettger calls the defiled air of the great towns, that the direction of the prevailing wind is studied, so that, even at five miles distance, the city air may have little chance as possible of reaching the patients.

Cellars are now abandoned for the pavilions of large hospitals, as they have long been for small ones. No use can or should be made of them, and it is much better to allow the air to blow freely through under the first floor. The best number of patients for a ward in general hospitals is generally agreed to be thirty, with twenty as the maximum for wards containing certain classes of patients. To secure the best effects of sun and air, the long axis of the wards should run north and south, instead of east and west, as in many of the older Continental hospitals. This gives sun on both sides of the room during some part of the day, and allows the "day room," or "sunning room," which is now an indispensable part of every large hospital ward, to be placed at the south end, where it does not shade any windows. Roofs should be flat, without air spaces between the rafters and ceiling, and covered with "wood cement," or similar material. Opinions still vary as to the best flooring. Some still prefer wood, but Herr Boettger considers that a pavement of smooth concrete, or Mettlach tiles, is much better, if suitable provision can be made for keeping it warm. The best material for walls is now agreed to be brick. Probably it is intended that they should be built hollow, for Herr Boettger continues that the inside face should be laid as smoothly as possible, with very close joints, and painted in oil to a height of seven feet above the floor, or else covered to that height with tiles. For hospitals for infectious diseases, the newest idea, which is certainly a good one, is to provide, in the hospital grounds, a number of monolith platforms of concrete, of suitable size, on which temporary structures can be erected at any time, either in winter or summer, in a few days, or even in a few hours, and cleared away as quickly after the exigency is past.

THE United States produce annually forty-six million tons of hay.

WHY FLOWERS ARE BEAUTIFUL.

BY THE EDITOR OF POPULAR SCIENCE NEWS.

Every seed is but a crystallized memory of the past history of its kind, and every plant the realization in fact and experience of the grandest features of that memory. That a developing seed could receive a fitness in its structure for a wet or rocky soil while grown upon that which is dry and loamy seems impossible. That such fitness should be carried as a message from plants of the same species miles away and taught to that seed before it had scarcely begun to develop in the parent flower, appears as if beyond sane belief. All this is nevertheless but a sober statement of what has been discovered by actual experiment. Two trees, shrubs or herbs, remote from each other, can interblend their natures and combine their powers through the medium of a tiny dust-like particle of pollen. The seeds and plants derived from the union possess in large degree the fitnesses of both. United through its pollen with others having different powers and experiences, a new race is born with a double capacity of adaptation. Professor Charles Darwin experimentally proved that crosses between individuals give vigor in proportion to the variety of conditions to which the parents are subjected, and not in proportion to remoteness of kin. Foxglove (Digitalis purpurea, Lin.), Fig. 1, when crossed from plants growing near together in similar soil, shade and surroundings, never gave as good seed as when crossed with pollen from plants of a remote neighborhood. ("Cross and Self-Fertilization," page 447.) The flower stems produced in the two cases were as 100 to 47, and the average height as 100 to 70. Plants near of kin, but raised in remote regions, when cross-fertilized with each other gave improved stock. Plants remote of kin, but grown near each other, when crossed gave inferior results. When we pass through the woods or garden and the little dust specks cling to our garments, how many of us pause to consider that each impalpable particle we are so desirous of brushing away is a volume containing more wonderful and more accurately recorded facts than any man could write? Viewed with the microscope, traces of its beauty appear in every distinct form assumed. Each kind of plant has a form for itself and, though borne on the passing winds miles away from the producing anthers, every tiny speck is sufficiently distinct to recognize its kind. In Fig. 2 is shown this dust from fifteen different kinds of plants, and surely no one could, after familiarity, confound them. Here is pollen from the lily (*a*), buttercup (*b*), hollyhock (*c*), enchanters' nightshade (*d*), wild balsam apple (*e*), mountain laurel (*f*), bassella (*g*), lark pine (*h*), evening primrose (*i*), chicory (*j*), white pine (*k*), musk plant (*l*), bur cucumber (*m*), passion flower (*n*), and scolymus (*o*). These external appearances are, in their way, remarkable, but they shed no light on a pollen grain's unfathomable potentiality.

Every grain seems to be husbanded for the perpetuation of the plant or in some indirect manner to aid that perpetuation. For a plant to squander its life force in producing a superabundance of pollen is to lessen its resisting power against adverse forces in some other direction. In the struggle for life those survived best that were able to get the largest number of healthy representatives with a minimum of such expenditure. Every plant that gained some contrivance to save its pollen from loss became the parent of more vigorous offspring. Little changes that aided but slightly were multiplied through successive generations until great changes were the result. Plants occupying positions that caused unusual strain upon their structures were those that such savings and the consequent reserve force benefited most. But this saving of pollen introduced a necessity for some contrivance to carry it in an economical manner from plant to plant. The method chosen shows the perfection of natural adjustment to a remarkable degree.

The pistils and their seed-bearing ovaries usually occupy the center, while the stamens, like a circle of sentinels, stand guard around them. This is seen in the cotton flower, Fig. 3. In this A is the pistil, B the stamens and C the ovary. Their production of pollen is also less, since the necessity to sow every inch of the country that perchance a few grains may strike the

Fig. 4.

stigma or top of the pistil of a kindred plant is now at an end. But how? The bringing together of both organs in a single blossom tends to self-fertilization, which has been shown to injure them. A careful examination of these flowers will reveal a most wonderful and almost numberless set of contrivances evidently intended to keep the pollen of the same blossom from reaching its stigma. These are in all degrees of perfection, from those that allow of free contact to those that exclude all possible contact. As they would all most surely perish without fertilization, and as they would slowly, but as certainly, deteriorate by self-fertilization, their winged friends come to their relief, and with the greater certainty the more enticing their forms, fragrance, and color. On any bright day of the summer months in the forest, on the prairie, or in the garden, insects can be seen at work consummating these unions. Butterflies and moths, bees and humming birds lingering around a bed of flowers are doing more than enjoying themselves with the fragrance and sipping the honey from the nectaries. The apparently trivial act of one of these in seeking food is fraught with changes of great importance to the floral world. They carry upon their bodies supplies of pollen which are borne from plant to plant. If you watch a bee as he forces his way down the honey-bearing gland of a fleur de luce (iris), Fig. 4, you will observe how he rubs his pollen-covered back against the stigma, A, on entering, but on finishing his repast he cannot return without a complete reversal of his body. This covers his back once more with pollen from B, which he carries to the next flower. In the mountain laurel (Kalmia latifolia) as he awkwardly tumbles among the bent stamens they spring up and cover him with their yellow dust. This he bears away to another plant of the same kind, where, by his movements, it is rubbed off upon the stigmas. Upon close inspection it will be found that, as a rule, the part of the insect bearing the largest pollen load is the very part he finds it necessary to turn toward the stigma in honey-bearing flowers when he seeks their sweet product. In lilacs and some others the insect first gets its head daubed with honey and then with pollen, which thus adheres, until reaching another flower it rubs past the stigma where it is deposited. In many other flowers the pollen is naturally rough or sticky and makes itself fast to whatever part of the insect presents itself. In some it is strung like beads on threads, in others it is in little packets cohering together. Sometimes it is projected with force against the insect so as to facilitate adhesion. In a few cases it is locked up in little boxes which the insect's touch opens. In some hinges and traps are devised so that the insect cannot enter the flower without throwing the pollen over itself as the touching of one part moves as a lever the other.

Wind-fertilized plants are frequently fertilized by insects, and from them it is believed all our pretty flowers sprang. They occasionally display beautiful colors when the vitality of a part is low, and honey and odor frequently can be found upon them. These were evidently the starting points for selection to work upon in leading up to lilies, geraniums and orchids. Those plants that displayed the greatest amount of a color pleasing to certain insects were most often visited and hence best fertilized. The least beautiful, if unable to continue producing pollen enough for wind fertilization, and failing to attract insects in sufficient numbers, were necessarily slowly extinguished. Every added beauty to a flower, by increasing its attractiveness, gave it the advantage in the struggle over its fellows, because it was made to produce more and better seeds. Features of color, shade or odor pleasing to one kind of insect proved displeasing or indifferent to another, so that a large variety of forms resulted. Dull yellow flowers are evidently obnoxious to beetles, for we find that they almost entirely avoid them. Dull purple seems to be the choice color of the host of minute insects that swarm around marshes, the margins of lakes and wet places generally. White is the favorite color of night-flying moths. Butterflies and bees choose brilliant reds, pinks, blues and violets. By actually counting the number of insects visiting various flowers during the course of a day, it is found to be the universal rule that where other things are equal those blossoms that are most conspicuous are oftenest visited —*Popular Science News.*

Fig. 1.

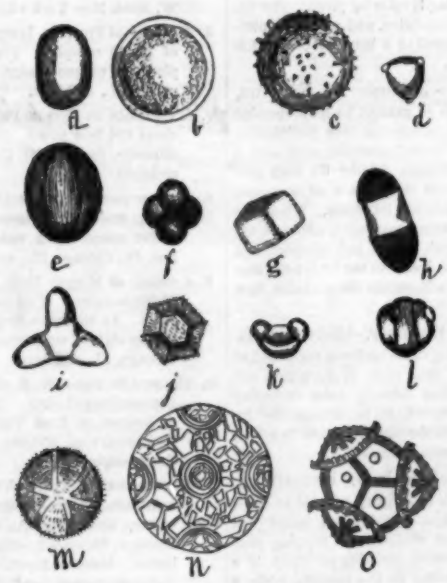


Fig. 2.

Fig. 3.

A Great Artificial Lake.

It is proposed to build at Cloquet, Minn., on the St. Louis River, a dam 900 feet long and 80 feet high, by which back water on the St. Louis will be extended sixty miles. A line of steel piping to the hills above Duluth will be laid, where a reservoir is to be built, whence, under a 600 foot head of power, electricity will be generated and distributed. Water will also be furnished for fire protection, and, if wanted, for drinking purposes. This project is said to be well matured, has the consent of the war department, controlling the river, and also of the saw milling interests at Cloquet. It is stated that the money needed for the project, some $3,500,000, is secured. A large share of the Fond du Lac reservation, which is, however, valueless for timber or agricultural purposes, will be flooded.

RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY ENGINE.—George W. Morthland, Lead, South Dakota. In the cylinder of this engine is a wheel secured upon the main driving shaft, the wheel having two pairs of oppositely arranged spring-pressed pistons, sliding in radial recesses, while on opposite sides of the cylinder are abutments, with curved sides, to permit the pistons to pass over them, the middle portions of the abutments being in frictional contact with the periphery of the wheel. The abutments are provided with ports for the live and exhaust steam, and the arrangement is such that the steam always acts on two oppositely arranged pistons at the same time, all dead center positions being avoided.

CUPOLA FURNACE.—James Blakeney, Springfield, Ohio. This furnace has radial tuyere openings which gradually increase in width from the inside to the outside, and whose bottoms are obtuse angled, whereby the air blast can readily pass to the center of the furnace from all the points of the wall, while the molten metal is prevented from filling up the tuyeres. In the bottom plate of the tuyere are also formed transverse pockets leading to passages in the bottom of a surrounding air chamber formed by the enlarged part of the shell for the stack, a pipe connected with the air blast discharging into this chamber.

FURNACE.—Augustus L. Engelbach and Sidney E. Bretherton, Leadville, Col. This is an improvement on a former patented invention of the same inventor, designed to prevent the incrusting of the settler by the molten products, and providing for the ready moving of the settler to or from the heater, if incrustation should take place. The settler is formed of a cast iron box lined with fire clay and provided on its outer side at the corners with slotted lugs and a wheeled frame into which the settler fits, there being vertical corner uprights with pivoted bolts to swing into the slots of the lugs.

GRATE.—James W. Smith, Moscow, Ky. This invention consists of a grate head in sections, each section having solid ends and longitudinal bars integral with the ends, each bar having in its top a deep longitudinal groove for the passage of air. The construction is designed to permit also a ready entrance of air between the grates to penetrate the fuel in all its parts, and to heat air which will travel at considerable velocity through the boiler flues.

HYDRAULIC ELEVATOR.—Charles J. Dudley, Mobile, Ala. This is an elevator of simple and durable construction, and is provided with novel arrangements to vary its lifting power according to the load of the cage, the varying device being controlled by the operator in charge of the cage.

Railway Appliances.

ELECTRIC RAILWAY SYSTEM.—Charles D. Tisdale, Boston, Mass. According to this system both rails, or one rail and an auxiliary conductor, may be used for conveying the current for driving the cars. The car truck is provided with three or more insulated car wheels, and furnished with one or more auxiliary wheels for taking the current from one of the rails or conductors and returning it to the other rail. It is designed with this improvement to avoid the necessity of using a trolley wire, main conductors being provided on the ground level, and so arranged as to be free from danger by being crossed by vehicles or otherwise.

RAILWAY SIGNAL COMPENSATOR.—William Davos, Jersey City, N. J. This an improvement in devices for taking up the slack in signal working wires, so as to compensate for the stretching of the wires and their varying lengths under temperature changes. The construction is very simple and inexpensive, and the parts are so arranged that they cannot well get out of order, while, if either of the operating wires breaks, the semaphore arm will swing to the position of danger.

FENDER FOR TRAM CARS.—Franklyn S. Hogg, New York City. This fender is concealed entirely beneath the car platform, and has a rear guard which, should the main fender be elevated by an obstruction working beneath it, would be brought down in operative position between the rails, preventing a person or obstruction from passing beneath the wheels. To the fender are connected spring-controlled plungers having limited sliding movement in bearings on the vehicle frame, and the improvement may be applied to any car without any interfering with the usual mechanism on the car bottom. It does not add to the length of the car, enabling the cars to be stored in as small a space as previously.

Miscellaneous.

ROAD WORKER AND SCRAPER.—Otis W. Stearns, Johnson, Vt. This is a machine with which the road may be scraped and rolled at the same time, the scraper being adjustable beneath the body of the machine in such manner as to carry the material removed from the road in direction of the front of the machine, or more or less in direction of either of its sides. The scraper may be raised and lowered quickly and conveniently, and shifted to stand at any desired angle laterally beneath the body of the machine. The machine is designed to be simple, durable, and inexpensive in construction, and equally well adapted for work in summer and winter.

BICYCLE CRANK.—Ferdinand F. Ide, Peoria, Ill. According to this a curved crank of spring material attached to the pedal shaft and under ordinary circumstances acts like the rigid crank commonly used, but it is designed to straighten out under heavy pressure, thus increasing its length and giving additional leverage, so that the rider's foot travels in an ellipse, and the increased leverage enables him to drive a machine easily up hill. The crank is designed to respond quickly to the thrust of the foot, without transmitting jar to the rider.

FIRE BOX AND GRATE.—Augusta R. Isaacs, New York City. This invention provides an auxiliary fire pot to be introduced into the regular fire pot of a range, stove, or heater. It may rest upon the bottom of the ash pit of the stove, and be entirely removed in a quick and convenient manner. This auxiliary fire pot has two grates, one or both of which may be removed, one of the grates being at the lower portion of the fire pot and constituting its bottom, and the other being between the bottom and the top, thus providing for the use of a greater or less amount of fuel. One or both of the grates has a rake attachment.

VALVE FOR HYDRANTS.—Christopher H. Watson, Riverside, Cal. This invention relates to valves used in connection with a measuring box for irrigating purposes, and provides improvements whereby the flow of the water from the supply to the box can be conveniently regulated according to the amount of water required for a certain purpose.

NUT LOCK.—Fredrick B. Wallace, Orion, Mich. The nut is perforated at one side of its threaded hole, according to this improvement, and channeled transversely on one face, while an independent locking block is perforated and threaded to conform with the bolt hole in the nut and seated in the channel. A tilting pin fast in the block is fitted loosely in the side perforation of the nut and projects beyond its inner face. The nut and bolt are thus locked without injury to the threads of either, permitting reuse an indefinite number of times.

SULKY.—Gilbert J. Loomis, Westfield, Mass. This invention provides means whereby the body of the sulky may be raised and lowered upon the wheel supports, enabling the vehicle to be used with equal facility with a large or small animal. The invention also provides for the employment of pneumatic wheels, and provides an attachment which will effectually prevent the sulky from being upset in a rearwardly direction.

BRIDLE.—James R. McLeod, Calgary, Canada. This is a harness bridle comprising the usual bit and a continuous cord having its free ends arranged to form the reins, the cord extending loosely through the bit rings, crossing beneath the jaws of the horse, crossing again above the top of the head, extending downward to form the check pieces of the bridle, connecting with the bit rings, returning upon themselves and merging in a loop adapted to form a noseband and overdraw and connect with the bit rings. This bridle may be used to render a horse easily manageable with any form of bit.

CLEVIS.—S. E. Bricker, Arco, Idaho. This clevis consists of two members having nearly circular hooks curved in opposite directions and lying side by side, the inner end of one member being provided with a keyhole slot, and a pin or bolt pivoted to one member and provided with a radial flange being adapted to enter the key hole slot of the other member. In practical operation the clevis works substantially like an ordinary clevis made of a single piece, while the parts may be easily separated and as easily locked, so that the clevis may be readily connected with any hauling or other device.

HOOK.—David W. Holden, Gardiner, Oregon. This hook is more especially designed for use with chains employed for logging purposes, and is arranged to conveniently unhook the load while under strain, to obviate backing up to "cast off." A shank is provided with a locking link to engage the hook pivoted on the shank, the latter having on the inside at the pivot end a projection to limit the inward swinging motion of the hook and protect the pivot.

LIGHT DEFLECTOR.—Dexter E. Hawkins, North Attleborough, Mass. This is a device to concentrate the light of a lamp or gas flame, and direct the rays upon the page of a book or on any object of work. In vertical members carried by a suitable base is a lens-carrying frame fitted to slide, with means for vertically adjusting the frame, to which is secured an apertured shield in rear of the lens. The lens is given any desired inclination by simply turning it upon its pivot. The device is very simple and inexpensive, and will not interfere with the stand or pedestal of a lamp in connection with which it may be used.

WALL DESK.—Joseph F. Figgins, Washington, D. C. A case or cabinet to be suspended from the wall or supported on legs has been provided by this inventor, the case having notched sides and a rounded lower piece, a vertically folding lid with projecting strips, and rigid strips on the side of the case, while hinges connect the side and lid strips. When the lid is lowered a desk for writing purposes is afforded, the construction being very neat, simple and compact, and the connection between the desk and the lid is such that a rigid support is attained without the use of chains, legs, or supporting arms.

WASTE PAPER BASKET.—Edward L. Weston, Washington, D. C. This basket is composed of upright strips curved at their ends to form feet and headings, rows of connecting strips in pairs encircling the basket, which is designed to be ornamented by running ribbons around and through the strips, to give it a very ornamental appearance.

ANIMAL TRAP.—Frank J. Bragunier, Topeka, Kansas. This is a simple trap adapted to catch small game alive, and when once set and baited will operate many times without resetting. A tripping platform is located in a bait box, at one side of which is a cage, a swinging door being in the passage, while a spring-revolved shaft in the bait box has arms designed to strike the animal and throw him through the opening into the cage.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

WOOLEN SPINNING. By Charles Vickerman. London and New York: Macmillan & Co. 1894. Pp. xii, 352. Price $1.75.

The advance of technology is well illustrated by the production of such works as the present. It treats of one of England's great industries, its history and progress and present aspect. It is fully illustrated, but its want of an index is especially to be deplored, as it would have added very greatly to its value and utility.

DIE PHOTOGRAPHIE IN NATURLICHEN FARBEN. Mit besonderer Berucksichtigung des Lippmann'schen Verfahrens. By Eduard Valenta. Halle a. S.: Wilhelm Knapp. 1894. 20 test figures. Pp. 89.

This book forms the second number of the Encyclopedia of Photography, and treats in a very exhaustive manner on photographing in natural colors, with special reference to G. Lippmann's process.

HOW TO THINK IN SPANISH. By Charles F. Kroeh, A.M., Professor of Languages in the Stevens Institute of Technology, Hoboken, N. J. Published by the author.

As in the author's books on French and German, the aim of "How to Think in Spanish" is to teach the language of everyday life by direct association of complete idiomatic sentences with the student's actions, so as to establish the habit of speaking Spanish without first conceiving the thought in English. Then, by a series of instantaneous mental processes, the student is taught to vary these sentences as a native does by substitutions and additions, so that he will acquire a real command of the language and not merely the ability to parrot a few sentences. The author has made an independent study of what he calls the "mechanism" of these languages and has given adequate practice in every grammatical difficulty.

We are in receipt of the thirteenth part of that handsome and lavishly illustrated quarto, "The Book of the Fair," published by the Bancroft Company, of Chicago. The completed work will consist of twenty-five parts, two being issued monthly, at the price of $1 a part.

READINGS FROM THE BOOK OF NATURE. By Simeon Mills. Chicago: Charles H. Kerr & Company. 1893. Pp. 181.

SCIENTIFIC AMERICAN BUILDING EDITION.

APRIL, 1894.—(No. 102.)

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1. Elegant plate in colors showing a handsome colonial residence just completed at Ashbourne, Pa, for Charles Salmon, Esq. Two perspective views and floor plans. Cost complete $11,500. Frank R. Watson, Esq., Philadelphia, Pa., architect. An elegant design.
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Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue

"U. S." metal polish. Indianapolis. Samples free.

Heading machinery. Trevor Mfg. Co., Lockport, N. Y.

Cheapest Water Power.—See top of 1st column, page 176. Also top of 3d column, page 229.

Distance Reading Thermometers.—See illus. advertisement, page 255. Ward & Doron, Rochester, N. Y.

Air compressors for every possible duty. Clayton Air Compressor Works, 26 Cortlandt Street, New York.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Nickel-in-slot machines perfected and manufactured Electrical supplies, Waite Mfg. Co., Bridgeport, Conn.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

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Emerson, Smith & Co., Ltd., Beaver Falls, Pa., will send Sawyer's Hand Book on Circulars and Band Saws free to any address.

Split Pulleys at Low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

The "Otto" Gas and Gasoline Engines, from 1 to 10 horse power, for all power purposes. The Otto Gas Engine Co., 222 Chicago Street, Buffalo, N. Y.

Patent for Sale—Stall for comfort and cleanliness of milk cattle. Agents wanted at 50 per cent commission. M. Schembri, 206 Van Buren St., St. Paul, Minn.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

Wanted—A slide valve engine of about 200 H. P. Must be in first class condition. Address, giving maker's name, date, and full particulars, also location, J. B. J., care this office.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(5989) L. B. asks (1) for directions for putting on shellac or varnish over rosewood stain so as to make it shine and give it a high polish. Would it be preferable to use the best varnish or shellac, and state how I shall proceed to put it on cherry wood so as to give it a glossy and polished like appearance? Also how shall it be rubbed or shined? A. First fill the rosewood, using the following filler: Linseed oil, 1 quart; spirits of turpentine, ½ pint; lime, the size of a base ball, broken fine. Let the mixture simmer on a stove, covered over, for two or three hours, then strain through a coarse cloth. It is to remain on twenty-four hours, then rub off with a woolen cloth and polish. Then varnish with the following:

Sandarac	6 oz.
Elemi (genuine)	4 "
Anime	1 "
Camphor	½ "
Alcohol	1 qt.

Digest the gums in the alcohol in a corked bottle, in a warm place. Have the wood smooth. No rubbing is necessary; several flowing coats of the varnish should be given, sandpapering between each with fine sandpaper. 2. What voltage would a battery of two cells have, each having two zinc plates and three carbon ones, each 3½ by 2¼, connected in series, and state the amperage? Immersed in electropoion fluid. A. 3 to 4 volts. The amperage depends on the resistance of the circuit. On short circuit they should give 6 or 8 amperes for a short time.

(5990) O. C. P. says: I have several small pieces of glass which I wish to color. Can you give me formulæ by which I can give them durable colors? A. The following is due to Mr. Arthur S. Huey, of Minneapolis: 1. Prepare the glass by thoroughly washing in soap and water and drying. Then dip in bath, made by beating up the whites of two eggs in 1½ pounds or pint of water and filtering, and hang up to dry. Dissolve the aniline color in photographer's common collodion. Red or blue aniline will form clear solutions, while the green solution will require filtering. Yellow aniline forms a handsome color, but the surface of the glass presents a frosted appearance after the application. Violet and purple colors may be obtained by combining red and blue in different quantities. When the solution is ready, dip the prepared glass bulbs therein, hang up to dry, and finally pass a current through the bulb for

half an hour, that the heat thus generated may harden the coating of the collodion, or place in a current of air. The preparation can easily be removed with alcohol or sulphuric ether, but is not affected by water. Experience has shown that the best results are obtained by not using too much aniline. Make the color light rather than deep, and apply two or three coats. These preparations may be used for coloring incandescent lamp bulbs. From the SCIENTIFIC AMERICAN Cyclopedia of Receipts, Notes and Queries.

(5991) F. E. B. writes: 1. In making telephone instruments, would ¼ an ounce of silk-covered No. 36 do to wind the spool? A. Yes. 2. What size spool should I make to hold that amount? A. Make the diameter of the small part of the spool as small as possible. The space between the flanges of the spools should be about ¼ inch, and the flanges should be ⅛ inch wide. 3. Should ⅜ round 6 inches long bar magnets be magnetized the whole length or just the end? A. Magnetize the bars as much as possible. The magnetism would show principally at the ends. 4. How can I harden them? They are tool steel. A. Harden only at the ends by heating to a cherry red and plunging in cool water. Draw the temper to a dark straw color. 5. Will 6 small tumbler bichromate batteries sufficiently magnetize them? A. Yes. 6. How many layers of what size wire should I use? A. 10 or 12 layers of No. 18.

(5992) R. P. J. asks: 1. In telephone systems is earth used to complete the circuit or is a return wire necessary? Why? A. In quiet places free from induction, the earth may be used, but where there is induction from adjacent lines, a return wire is desirable, as the induction currents are equal and opposite in the two wires, and therefore neutralize each other. 2. Is there any satisfactory method of placing more than one subscriber on a single line leading from central, without making it possible for all subscribers on that line to overhear conversation carried on by any one on same line? A. There are complicated cut-out devices which will permit of calling up any person on a line without calling up others. You will find descriptions of these in works on the telephone.

(5993) H. K. G. says: What can I put on drawing paper to make it transparent, so I can use it for tracing paper? A. Dissolve a given quantity of castor oil in 1, 2, or 3 volumes of absolute alcohol, according to the thickness of the paper, and apply it by means of a sponge. The alcohol evaporates in a few minutes and the tracing paper is dry and ready for immediate use. The drawing or tracing can be made either with lead pencil or Indian ink, and the oil removed from the paper by immersing it in absolute alcohol, thus restoring its original opacity. The alcohol employed in removing the oil is preserved for diluting the oil used in preparing the next sheet.

(5994) C. F. N. writes: 1. How many ounces of bichromate of potash will saturate a half gallon of water? How many fluid ounces of sulphuric acid should be added? If the plates are 5×6 and close together in a half gallon jar, how much resistance will the battery have? A. The quantity depends on the temperature. For battery add 1¼ parts by weight of potassium bichromate in fine powder, 10 parts of water, and add slowly with constant stirring 4½ parts by weight of oil of vitriol. Use after cooling. The battery will have about one-tenth ohm resistance. 2. What horse power (approximately) will simple electric motor develop with 8 cells plunge battery, plates 5×7? How many amperes of current should be sent through it to obtain best results with greatest power? What is the power? A. Possibly one-fifth horse power at 6 or 7 amperes. 3. Could it be run as a dynamo with wrought iron fields? Are they better than cast iron? A. It would not work well as a dynamo. 4. Would a solid copper commutator be better than one described? What diameter should it be? A. A regular copper bar commutator would be better than the one described. There is no special diameter—the smaller the better, if properly constructed.

(5995) G. I. B. T., Peoria, Ill., asks what the weight of a water tower and contents are. The tower is twenty feet across and one hundred and twenty feet tall. The first five sections are of ¾ inch steel, the second five sections are of ⅝ inch steel, the third five sections are of ½ inch steel, and the last nine sections are of ⅜ inch steel, and filled with water within ten feet of top. A. The steel tower weighs 258 tons, including the bottom, if also of ¾ inch plate; 110 feet of water height weighs 1082 tons; together 1340 net tons, or 4½ tons per square foot of its base.

(5996) C. & T. ask: 1. Are growing flowers and plants in bedroom injurious to health of occupants? A. There is danger of their being so. It depends on the plants. 2. Do coal ashes possess any value as a fertilizer? If not, are same injurious to soil? A. Little or none, except a mechanical value in clay, as loosening and lightening the soil. 3. How are roses propagated? A. They may be propagated by cuttings. We can supply Parson's "On the Rose, a Treatise on the Propagation, Culture and History of the Rose," price $1 mailed.

(5997) C. N., Ontario, asks information regarding best appliance to use for elevating water in draining some low land. I wish to elevate over dam from ditch, average lift about 20 inches, amount of water to be handled about 3 acres, covered to depth of say 10 inches, time for disposing of it, say 3 to 5 days. Would suction pump elevator buckets driven by chains and sprocket wheels, or cylinder with rotatory spiral, be preferable? Please give plan of construction of what you deem best. What amount of power would be required to drive it? Would a gasoline engine answer the purpose? Does a gasoline engine require attention after starting, or would it operate for several hours without attention? A. Assuming that you may have to lift 129,000 cubic feet of water 2 feet for clearance over the dam, you will need to lift 30 cubic feet per minute for 3 days of 24 hours each, or 5 days of 18 hours each day. This is equal to 2,750 foot pounds per minute. Allowing 50 per cent for friction and loss, will require ⅛ of a horse power. In the application of a gasoline or petroleum engine for this work a much larger power will be required by the commercial rating of such engines. A bucket breast wheel 5 feet diameter, 8 inches wide, with 15 buckets, shrouded on the sides, running in a one-fifth circle trough at a speed of 12 to 15 revolutions per minute. Shaft extended with a sprocket wheel and chain from the engine shaft. Engine making 100 revolutions per minute. The gasoline and petroleum engines will work many hours without attention.

(5998) A. L., L'Epiphanie, P. Q., asks: Is it possible to boil water, bubbling as much as water in a kettle on a very hot stove, in an open vessel holding about 4 gallons, with steam at 50 pounds pressure? I do not want steam being mixed with said water. If there is any possibility to do so, please inform me how to do it. A. Yes; you can boil the kettle over with steam at less than 50 pounds pressure. Use a flat bottom kettle 14 inches diameter and any convenient height to hold the 4 gallons, say 8 or 10 inches. Make a flat spiral coil of ¾ inch copper pipe, using 14 feet of pipe, each coil separated so as to allow of water circulation between the pipes; turn the ends up to clear the kettle and connect one end with the steam and the other end to waste, with a valve to keep back the pressure and drip away the water of condensation.

(5999) E. M. G.—Dr. L. O. Howard, Acting Entomologist, Dept. of Agriculture, says: The insect you sent is the common bag worm (*Thyridopteryx ephemeræformis*). It is in the egg state at present, the eggs being laid inside the cocoon from which the female moth has issued. The larva feeds protected in the bag, but may easily be destroyed by spraying with Paris green or London purple in the proportion of one-fourth pound to 50 gallons of water.

(6000) W. E. L. says: Please inform me of the best material to use to prevent the nitric acid from eating fine lines away in photo zinc etching for the greatest depth in quick work. A. Dust with powdered dragon's blood and heat until the etching ink and dragon's blood fuse. For full directions see Schraubstadter's "Photo-Engraving, with Copy for Photo-engraving," which we mail for $3.25.

(6001) J. D. W.—The average rise and fall of the tide at New York is 4½ feet. Liverpool, 20 feet 31 inches. London, 21 feet 10 inches.

(6002) A. G. P. asks: 1. How many caustic potash batteries of the large size described in "Experimental Science" will it take to run motor 641, and would they be a good kind of battery to charge storage batteries with, and how many will it take to charge 3 storage batteries like those described in "Experimental Science"? A. Ten or fifteen would run the motor. It would take twelve to charge 3 storage cells. 2. What is the voltage and amperage of battery described in SCIENTIFIC AMERICAN, April 11, 1885, page 230, with tin cell 6 inches by 5 inches? A. We have no exact figures. Allow 0·6 volt and ¼ ohm internal resistance. 3. Is it a constant battery, and is there any action in the cell when the circuit is open? A. It is constant and unattacked on open circuit. 4. Should the zinc be amalgamated? A. No. 5. How long will it last in constant use? A. It depends on the current taken from it.

(6003) F. H. writes: I want to build a small electric motor of the Froment type, in which armatures placed round the circumference of a wheel are successively attracted by an electro-magnet. During the day I want to use the motor. I have a battery (Fuller-Leclanche type) of 6 cells for an incandescent lamp. I think an electro-magnet of high resistance would prevent the battery from being exhausted so soon on the motor; if not, kindly give me the necessary instruction for this kind of motor. A. A high resistance motor would save the battery, but might tend to reduce the power. For electric motor construction we refer you to our SUPPLEMENT, Nos. 641, 759, 761, 767, 783, 844, 865, and to "Electric Motor Construction for Amateurs," by Parkhurst, price $1; Bottone's "Electro Motors," price 75 cents mailed. Your battery and motor should be adapted for each other.

(6004) G. C. W. asks: 1. Can an alternating current of electricity be taken from a sectional commutator? A. Yes; but at a disadvantage. 2. Can a continuous current be taken from a commutator, composed of rings on the armature shaft? A. Yes; under proper conditions, not as dynamos are ordinarily wound. 3. Why in a dynamo is one wire from each of two segments connected with one bar of the commutator? A. As a matter of mechanical convenience and to avoid sparking and to secure electrical balance. 4. Please explain a shunt-wound dynamo. A. The ends of the field wires are connected to the brushes, thus bringing the field and outer circuit in parallel.

(6005) C. C. S. asks: 1. Can small dynamo, say 75 light 16 candle power, direct current, which refuses to start with no visible reason why it should not, be made to start by momentarily short-circuiting across brushes while at full speed, and why? A. If series wound, this will tend to send a heavy current through the field coils, and thus start the machine. 2. Is it good practice to connect 16 candle power lamps, 10 in series, direct from mains of 1,100 volt alternator circuit, and why? A. This is done for street lighting; it is bad practice in house lighting, as it involves a dangerous potential. 3. Have telephone transmitters been made which operate by the vibrations opening and closing a circuit around induction coil? A. The operation described is not adapted for telephoning, the variations are so sudden. 4. How is Edison carbon telephone made? A. See our SUPPLEMENT, No. 127. 5. Can spools for electro-magnets be made of tin tube with brass or copper heads and be as effective as made of paper or rubber? A. Yes.

(6006) H. D. W. asks: Can sulphate of magnesium ($MgSO_4$) be decomposed into magnesia (MgO) and sulphuric acid (H_2SO_4) by passing superheated steam over the anhydrous $MgSO_4$? How complete is the reaction and what conditions are most favorable to it? A. At a high enough heat the decomposition spoken of might be produced.

(6007) F. D. H. writes: How may I refill the tube of a barometer from which a part of the mercury was lost by the instrument falling? The tube is turned up at lower end, and has stopcock between bend and cistern. A. You will probably have to boil or heat strongly the mercury. The operation is a difficult one and should only be undertaken by an expert, as there is great danger of breaking the tube.

TO INVENTORS.

An experience of forty-four years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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April 24, 1894,

AND EACH BEARING THAT DATE.

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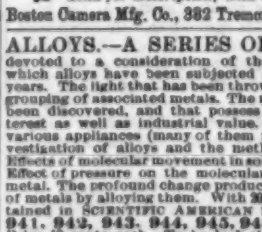
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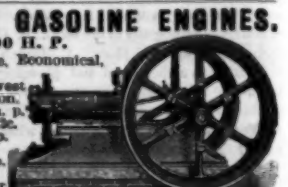
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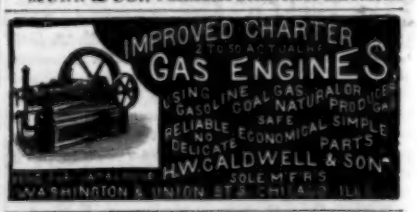

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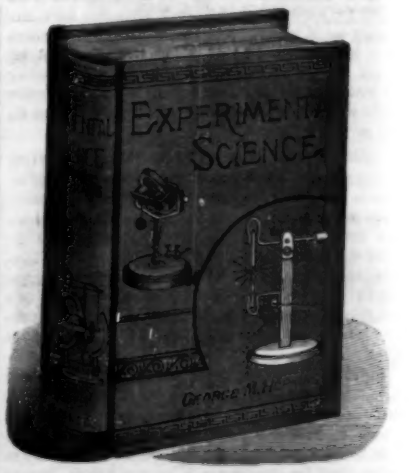

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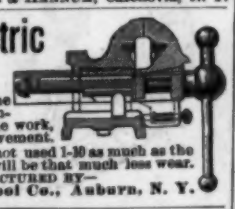

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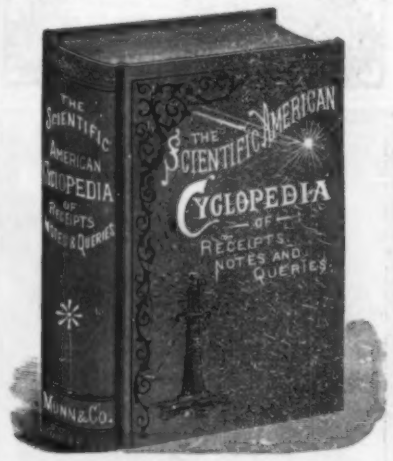

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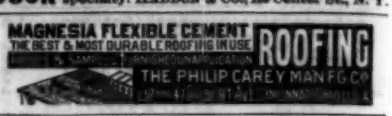

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